National Library of Canada
Bibliothèque nationale du Canada

Canadian Theses Service
Service des thèses canadiennes

Ottawa, Canada
K1A 0N4

NOTICE

The quality of this microform is heavily dependent upon the quality of the original thesis submitted for microfilming. Every effort has been made to ensure the highest quality of reproduction possible.

If pages are missing, contact the university which granted the degree.

Some pages may have indistinct print especially if the original pages were typed with a poor typewriter ribbon or if the university sent us an inferior photocopy.

Previously copyrighted materials (journal articles, published tests, etc.) are not filmed.

Reproduction in full or in part of this microform is governed by the Canadian Copyright Act, R.S.C. 1970, c. C-30.

AVIS

La qualité de cette microforme dépend grandement de la qualité de la thèse soumise au microfilmage. Nous avons tout fait pour assurer une qualité supérieure de reproduction.

S'il manque des pages, veuillez communiquer avec l'université qui a conféré le grade.

La qualité d'impression de certaines pages peut laisser à désirer, surtout si les pages originales ont été dactylographiées à l'aide d'un ruban usé ou si l'université nous a fait parvenir une photocopie de qualité inférieure.

Les documents qui font déjà l'objet d'un droit d'auteur (articles de revue, tests publiés, etc.) ne sont pas microfilmés.

La reproduction, même partielle, de cette microforme est soumise à la Loi canadienne sur le droit d'auteur, SRC 1970, c. C-30.

NL-339 (r. 88/04)

Canada

THE UNIVERSITY OF ALBERTA

SKILLS VERSUS PROCESSES IN PREDICTING GRADE ONE ACHIEVEMENT: A LONGITUDINAL STUDY

by

FAITH ALICE HAMBROOK

A THESIS
SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE
OF MASTER OF EDUCATION

IN

SCHOOL PSYCHOLOGY

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY
EDMONTON, ALBERTA
SPRING, 1988

Permission has been granted to the National Library of Canada to microfilm this thesis and to lend or sell copies of the film.

The author (copyright owner) has reserved other publication rights, and neither the thesis nor extensive extracts from it may be printed or otherwise reproduced without his/her written permission.

L'autorisation a été accordée à la Bibliothèque nationale du Canada de microfilmer cette thèse et de prêter ou de vendre des exemplaires du film.

L'auteur (titulaire du droit d'auteur) se réserve les autres droits de publication; ni la thèse ni de longs extraits de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation écrite.

ISBN 0-315-42930-5

THE UNIVERSITY OF ALBERTA

RELEASE FORM

NAME OF AUTHOR: FAITH ALICE HAMBROOK

TITLE OF THESIS: SKILLS VERSUS PROCESSES IN PREDICTING GRADE ONE ACHIEVEMENT: A LONGITUDINAL STUDY

DEGREE: M. Ed.

YEAR THIS DEGREE GRANTED: 1988

Permission is hereby granted to THE UNIVERSITY OF ALBERTA LIBRARY to reproduce single copies of this thesis and to lend or sell such copies for private, scholarly or scientific research purposes only.

The author reserves other publication rights, and neither the thesis nor extensive extracts from it may be printed or otherwise reproduced without the author's written permission.

F. Hambrook

Student's Signature

Student's Permanent Address

Box 11, Site 1, R.R. 4

Stony Plain, Alberta

Date: April 18, 1988

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled "Skills Versus Processes in Predicting Grade One Achievement: A Longitudinal Study" submitted by Faith Alice Hambrook in partial fulfilment of the requirements for the degree of Master of Education in School Psychology.

.....
Supervisor

.....

.....

Date ...April 18, 1988...

ABSTRACT

The present longitudinal study was undertaken to (1) identify the best test(s) and/or subtest(s) that would accurately predict grade one achievement, (2) determine whether skills or processes were the more important prerequisite to academic success, and (3) identify kindergarten readiness factors teachers deemed essential for future achievement.

The Pupil Rating Scale, Visual Aural Digit Span Test, Developmental Test of Visual Motor Integration, and Metropolitan Readiness Test were administered to 235 kindergarten children in the Edmonton Public School System (Year I). Kindergarten teachers submitted a prioritized list of readiness factors. During Year II, the Stanford Achievement Test was administered. Information on reading achievement, mathematics achievement, and actual grade one performance was obtained from school records.

Results of the study revealed that single tests were not adequate predictors of grade one achievement. The multiple regression analysis of the entire test battery indicated that Year I predictor variables contributed significantly to the equation. Year II tests, except the Developmental Test of Visual Motor Integration, were significant

predictors of grade one achievement. A combination of subtests was a better predictor of future achievement. A discriminant function analysis revealed that skills and process variables with an auditory component had the greatest power to influence predictions. Kindergarten teachers identified listening abilities and a positive self-concept as important readiness factors.

Results of the study were discussed in relation to past research and implications for psychologists, educators, and future research.

ACKNOWLEDGEMENTS

I would like to acknowledge and thank Dr. H. Janzen for his support and guidance throughout the course of this study. I would also like to thank Dr. R. Mulcahy and Dr. K. Ward for serving on the committee.

Gratitude is expressed to the students, parents, principals, and teachers of the Edmonton Public School Board for their participation and cooperation in this study--without them this study would not have been possible.

My sincere appreciation is extended to Noreen Paananen for her time, energy, help, and support in every phase of the study. Thanks are due to Cathy Oldham, Debbie Thompson, Linda Manson, and June Isbister for assistance in testing; and to Noreen Paananen, June Isbister, and Ruth Keeley for assistance in scoring.

Finally, I would like to express my appreciation to everyone who indulged me in my many moods throughout this study.

TABLE OF CONTENTS

CHAPTER		PAGE
I	INTRODUCTION	1
	Historical Perspective	1
	Why Study Readiness	6
	Nature of the Study	7
	Research Questions	9
II	LITERATURE REVIEW	11
	Introduction	11
	Concept of Readiness	12
	Developmental Perspectives of Readiness	14
	Maturational Viewpoint	14
	Behavioral Viewpoint	17
	Cognitive-Developmental Viewpoint	20
	Readiness Assessment	21
	Types of Instruments	24
	Readiness Tests	28
	Teacher Rating Scales	35
	Psychometric Approaches	46
	Specific Predictive Instruments	55
	Visual Motor Perception	55
	Auditory-Visual Perception	61
	Summary	66

CHAPTER		PAGE
III	RESEARCH DESIGN AND PROCEDURE	69
	The Sample	69
	Instruments	70
	Metropolitan Readiness Test	70
	Pupil Rating Scale	71
	Visual Aural Digit Span Test	73
	Developmental Test of Visual Motor Integration	76
	Stanford Achievement Test	77
	Procedure	79
	Administration of the Instruments	80
	Statistical Procedures	81
	Delimitations of the Study	82
	Limitations of the Study	82
IV	RESULTS	84
	Descriptive Statistics	84
	Multiple Regression Analyses	86
	Predictive Accuracy of Single Tests	87
	Question 1	87
	Question 2	87
	Question 3	87
	Question 4	89

CHAPTER PAGE

Predictive Accuracy of the Test Battery 91

Question 5 91

Predictor Variable Subtest Effectiveness 100

Question 6 100

Skills Versus Process--Power to Predict 117

Question 7 117

Kindergarten Teachers' Readiness Constructs.. 123

Question 8 123

Relationship Between Kindergarten Teachers' Readiness Constructs and the Pupil Rating Scale Constructs 133

Question 9 133

Summary 138

V DISCUSSION 144

Introduction 144

Relationship Between the Findings and Previous Research 146

Implications for Psychologists 157

Implications for Educators 160

Implications for Future Research 162

REFERENCES 165

CHAPTER PAGE

APPENDIX A: An Abbreviated Listing of Criterion and Predictor Variables 183

APPENDIX B: Summary of Descriptive Statistics 186

APPENDIX C: Pearson Correlation Coefficients: Intercorrelations of Predictor Variables and Criterion Variables 193

LIST OF TABLES

TABLE		PAGE
1	Three Separate Predictor Tests with the Metropolitan Readiness Test	88
2	Metropolitan Readiness Test with Six Criterion Variables	90
3	Multiple Regression Analysis of Three Predictor Variables with the Metropolitan Readiness Test--Year I (N=235)	92
4	Multiple Regression Analysis of Four Predictor Variables with the Stanford Achievement Test--Year II (N=112)	92
5	Multiple Regression Analysis of Four Predictor Variables with the Edmonton Public School Reading Test--Year II (N=112)	94
6	Multiple Regression Analysis of Four Predictor Variables with the Edmonton Public School Mathematics Test--Year II (N=112)	94
7	Summary of the Multiple Regression Analysis of the Accuracy of Using the Entire Test Battery to Predict Grade One Achievement	95

TABLE PAGE

8 Predicting Grade One Achievement Using the Actual Pass/Fail Results of Grade One--Year I (N=112) 98

9 Predicting Grade One Achievement Using the Actual Pass/Fail Results of Grade One Achievement--Year II (N=112) 99

10 Rank Order of Coefficients of Correlation of All Predictor Variable Subtests with the MRT Criterion 102

11 Multiple Regression Analysis of Seventeen Predictor Variable Subtests with the Metropolitan Readiness Test--Year I (N=235) 103

12 Rank Order of Coefficients of Correlation of All Predictor Variable Subtests with the SAT Criterion--Year II 105

13 Multiple Regression Analysis of Twenty-five Predictor Variable Subtests with the Stanford Achievement Test Criterion--Year II (N=112) 106

14 Rank Order of Coefficients of Correlation of All Predictor Variable Subtests with the

TABLE PAGE

EPSR Criterion--Year II 108

15 Multiple Regression Analysis of Twenty-five Predictor Variable Subtests with the EPSR Criterion--Year II (N=112) 109

16 Multiple Regression Analysis of Twenty-five Predictor Variable Subtests with the EPSM Criterion--Year II (N=112) 109

17 Rank Order of Coefficients of Correlation of All Predictor Variable Subtests with the EPSM Criterion--Year II (N=112) 110

18 Summary of the Rank Order of Coefficients of Correlation and Multiple Regression Analysis of Predictor Variable Subtests with the Criteria 113

19 Discriminant Function Analysis of Actual Pass/Fail Results in Grade One; Rank Order of Predictor Variable Subtests by Effectiveness 116

20 Rank Order of Skills Versus Processes in Predicting Grade One Achievement 119

21 Discriminant Function Analysis of a Process Test for Predicting Grade One Achievement ... 121

TABLE PAGE

22 Discriminant Function Analysis of a Process Test for Predicting Grade One Achievement 122

23 Summary of Rank Order Analysis of the Power of Skills Versus Processes to Influence Prediction 124

24 Frequencies of Kindergarten Teachers' Readiness Constructs (N=11) 125

25 Frequency of Kindergarten Teachers' Readiness Constructs by Behavior Category ... 129

26 Equating Kindergarten Teachers' Readiness Constructs with the Pupil Rating Scale Constructs 134

A Kindergarten Year 187

B Grade One Year 189

C Means and Standard Deviations of All Variables.. 190

D Differences in Means (Males versus Females) 191

E Pearson Correlation Coefficients 193

CHAPTER I

INTRODUCTION

Historical Perspective

Educators have always sought the most effective method of educating children. In recent decades, educators have seriously questioned why some children learn readily and others do not. The result has been an explosion of research directed toward answering this question. Special educators were concerned with meeting the needs of every child. Thus, interest in the identification of children experiencing or likely to experience academic failure became the focal point of much research. Cases of children with mental retardation, emotional disturbance, social, and emotional deprivation were more easily identified but children with milder psychoeducational problems were not being identified until the problems became severe.

Major interest in the area of identification of children experiencing or likely to experience academic failure began in the United States during the 1960's. Dunn (1968) and Slingerland (1969) argued that emphasis should be placed on diagnosis and treatment of areas of weakness rather than on procedures of identification, classification, and placement of children with learning difficulties. Their reasoning

was that these children should derive some benefit from the identification process. Consequently, the area of remediation of learning difficulties received much attention.

Another area of interest was early childhood education. Educators had begun to realize that remediation of older children was a slow, costly, and frequently fruitless exercise. In 1966, the School Trustees Association of Alberta, with the aid of Dr. Walter H. Worth, investigated the need for early childhood services in the province. The result was a universal kindergarten program in Alberta (Flynn & Flynn, 1978). With the advent of universal kindergarten programs, identification and prediction of academic problems shifted down to preschool age.

The direction of education during the 1970's was greatly influenced by the United States Public Law 94-142 (PL94-142) which entitled handicapped children to an equal opportunity for an education, regardless of the handicapping condition (Goldenberg, 1978). According to Judkins (1979), the legislative guarantees in Alberta for children with handicapping conditions is now similar to the period in the United States prior to the enactment of PL94-142 (Morrow, 1981). The Alberta School Act contained no provision for mandatory special education programs. Recently, an Alberta

court ordered the Lamont School system to provide educational services to a cerebral palsied child (Carriere versus County of Lamont, 1978). This case may signify the beginning of a trend toward provisions of education similar to that of PL94-142.

Another thrust of the 1970's was the expressed desire of educators to provide preventative rather than remediative education (Abidin, 1980; Derevensky, 1981; Evans, 1977; Fine, 1980; Telegdy, 1974; Wendt, 1978). Consequently, the importance of early identification of kindergarten children not ready to meet the demands of first grade became a high priority. Many researchers (Gallerani, O'Regan, & Reinherz, 1982; Gracey, Azzara, & Reinberg, 1984; Reinherz & Griffin, 1977) have emphasized the need for accurate identification prior to experience with failure. It was argued that early identification and intervention increased the chances of success, and thereby minimized the risk of premature labels and psychological effects frequently associated with failure (Wilborn & Smith, 1974).

Some investigators of the 1970's came to the realization that readiness was important in the identification process. Educators wanted to know when children were ready for school and when was the appropriate time to introduce

various curriculum tasks. Nearly all of the research on readiness has been based upon kindergarten or grade one children, although there has been an increasing number of studies directed towards assessment of the predictive ability of readiness tests (Abrahamson & Bell, 1979; Book, 1974; Satz & Fletcher, 1979; Tokar & Holthouse, 1977).

Various populations have been studied including groups of upper-middle socioeconomic status, low socioeconomic status, inner-city, and rural children, as well as various ethnic groups. A wide variety of readiness tests have been employed in an attempt to locate the most effective instrument. Single variable studies became prominant (Abrahamson & Bell, 1979). In addition, various rating scales were assessed as indicators of readiness (Lindsay & Wedell, 1982). Other investigators studied the utility of a battery of tests for predicting potential academic failure (Book, 1974; Busch, 1980). Even though it has been agreed that early identification of potential academic failure is crucial to preventive education, there has been no consensus as to the best test or tests for identification at an early age.

Within the current decade, investigators have attempted to determine the source of the problem of assessment. According to Busch (1980): "In spite of the years of

research efforts directed toward the problem, results have been inconclusive. It is still not known what contributes to failure" (p. 39). Other investigators claimed that the source of the problem was the lack of a precise definition of the term "readiness". Both Weerdenburg (1983) and Stewart (1978), after extensive reviews of the literature, concluded that the concept of "readiness" was a vast, unresolved question. Lipson (1981) stated that "school districts would be hard pressed to develop an efficient screening battery suitable for the relatively short attention span of this age group" (p. 457). According to Flynn and Flynn (1978), the source of the problem could be attributed to (a) the lack of any "real academic content" to measure, and (b) the rapid fluctuations in the development of these young children (cited in Nadon, 1983). Given these factors, results of assessment would not be very reliable.

A number of investigators have attributed the difficulty of readiness assessment to the instruments themselves. Lindquist (1982) claimed that many readiness instruments lack predictive validity. According to Abrahamson and Bell (1979), the problem was one of "a lack of even minimal information" regarding both the reliability and validity

of many readiness tests used to predict academic failure. Current investigators are still faced with the problem of adequate readiness tests to accurately predict potential academic failure.

Why Study Readiness?

From a review of the previous research, it was evident that educators have sought to find a method of educating children in which failure does not occur--preventive education. The provision of preventive education implied early identification and intervention prior to academic failure or the preschool years. Since the school setting was considered an ideal place to screen children, kindergarten became the target age for early identification procedures. Prediction of future academic success or failure was based upon readiness assessment results.

An awareness that children have continued to be misclassified regardless of the readiness test(s) used, indicated that many readiness tests were not accurate indicators of readiness. The cumulative result of years of research has been that there is (a) no agreement among investigators as to the definition of readiness, (b) no consensus on the best screening procedure for determining

readiness, and (c) no common understanding of what constitutes a good readiness program. Recent research, according to Stewart (1978), indicated that readiness skills may involve different and more basic skills than those investigators previously considered, thus, suggesting that re-evaluation of those skills essential to readiness were in order.

The benefits to educators of defining the term "readiness" and analyzing the component skills essential to readiness, combine to make the topic of readiness one worthy of further investigation.

Nature of the Study

"Since kindergarten education has become a nationwide phenomenon, it is likely that readiness assessments will continue" (Mitzel, 1982). Thus, the need for an appropriate screening procedure becomes extremely important. The development of such a procedure would involve having a clear understanding of the concept of readiness, as well as knowledge of skills and/or processes to be measured. Further, knowledge of the kindergarten teachers' perceptions of essential readiness factors would seem important, since teacher rating scales have been the best predictors of readiness (Flynn & Flynn, 1978; Keogh, Tchir, & Windeguth-

Behn, 1976; Stevenson, Parker, Wilkinson, Hegion, & Fish, 1976; Weerdenburg, 1983).

The purpose of this study was to determine: (a) whether the psychological battery could predict the future achievement of kindergarten children, (b) whether skills or processes were the more important prerequisites to academic success, and (c) what practical value this assessment procedure may have for psychologists and ultimately teachers.

Kindergarten teachers performed three functions in the following order: (a) prioritized a list of readiness factors they deemed essential to school success, (b) completed a rating scale for each subject, and (c) administered a readiness test measuring acquired skills to each subject in small group settings. Graduate students administered tests measuring auditory, visual, and motor processes to each subject individually. Predictions of future achievement were then made by the researcher. Also, the kindergarten teachers' lists of readiness constructs were analyzed and compared to the formalized rating scale constructs.

In the follow-up assessment at the end of grade one, the classroom teacher administered a standardized achievement test. Further information on academic achievement was obtained from cumulative records on each subject. These

criterion variables were analyzed to determine how accurate the earlier predictions were, as well as to determine whether acquired skills or processes were more important factors of readiness. Finally, the whole study was evaluated to determine what practical value this assessment procedure may have for psychologists in terms of assessments and teachers in terms of instruction and programming.

The researcher started from the assumption that specific skills and modalities contribute more to successful learning and undertook to answer the following research questions.

Research Questions

Question 1--What percentage of the variance is accounted for by using the Pupil Rating Scale (PRS) (Myklebust, 1971) to predict grade one achievement?

Question 2--What percentage of the variance is accounted for by using the Developmental Test of Visual Motor Integration (VMI) (Beery & Buktenica, 1967) to predict grade one achievement?

Question 3--What percentage of the variance is accounted for by using the Visual Aural Digit Span Test (VADS) (Koppitz, 1977) to predict grade one achievement?

Question 4--What percentage of the variance is

accounted for by using the Metropolitan Readiness Test (MRT) (Nurss & McGauvran, 1976) to predict grade one achievement?

Question 5-- What is the percentage of accuracy of predicting grade one achievement using the entire test battery?

Question 6--What is the rank order of predictor variable subtests from the most effective predictor to the least effective?

Question 7--Which has the greater power to influence predictions--processes or skills?

Question 8--What is the rank order of the kindergarten teachers' readiness constructs from the most important to the least important?

Question 9--Do the local kindergarten teachers' readiness constructs equate with those of the PRS?

Question 10--What are the practical implications of this assessment procedure for psychologists and teachers?

CHAPTER II

LITERATURE REVIEW

Introduction

Much has been written about the importance of readiness in the educational process. Certainly, all educators concerned with provision of preventive education have been interested in readiness for learning. They have wanted to know: (a) when is a child ready for formal schooling, (b) how could one accurately distinguish between those who are ready to learn and those who are not, (c) what could be done to stimulate readiness, and (d) when would be the correct time to introduce various academic tasks. There still remains some controversy among investigators as to what constitutes readiness and the way it develops in children (Stewart, 1978).

The following review of the literature focused on research of the past three decades which pertained to readiness for school entry. The chapter is divided into four sections: (a) concept of readiness, (b) developmental perspectives of readiness, (c) readiness assessments, and (d) specific predictive instruments. A review of these aspects of readiness will assist the reader to understand the current situation.

Concept of Readiness

In the literature, the concept of readiness has been confounded by the ambiguity of its definition and assessment, as well as the extensive debate over the factors that influence it. Bruner (1960) believed that "the foundations of any subject may be taught to anyone at any age in some form" (p. 7), and thus inferred that a degree of readiness was always present. According to Ames and Ilg (1965), learning could only occur when a child reached an appropriate level of maturation, a matter of genetic forces rather than environmental stimulation. Supporters of the Bruner position would suggest that the school was responsible for adopting instructional techniques to enable children to profit from instruction. Conversely, Ames and Ilg would recommend that instruction be postponed until the child matured sufficiently to handle the concepts taught (Kulberg & Gershman, 1973). Tyler (1964) warned against becoming embroiled in the nature-nurture controversy and instead suggested focusing efforts on enhancing readiness.

The literature revealed that there is no general consensus regarding a definition of readiness. Readiness usually has been considered essential for beginning school, although the concept of readiness could be appropriately

applied at all levels of instruction. For instance, to be ready for higher-level academic instruction, a student must have mastered the prerequisite skills. Readiness for school entry has been considered a more complex topic. According to Salvia and Ysseldyke (1981), readiness for grade one or kindergarten was a "generalized readiness" which referred to both academic and social readiness. Academic readiness, though frequently thought of in terms of reading readiness, properly included readiness for all areas of academic instruction. Social readiness was also considered essential to school entry because children are expected to cope with the social mileau of school. They must follow directions of an adult other than their caretaker, demonstrate cooperative behavior in peer ventures, and possess many self-help skills such as toileting and dressing.

Other studies have indicated that cognitive skills, perceptual-motor skills, emotional-social factors, and language, taken singly or in combination, constituted readiness. Kindergarten teachers, however, may view attention span, speech and language, reading, social maturity, or even activity level as essential components of readiness (Weerdenburg, 1983). Salvia and Ysseldyke would argue that all of these factors could properly be categorized as

either academic or social readiness. For the purpose of the present study, readiness will be regarded as "generalized readiness" and include readiness for all areas of academic instruction.

Developmental Perspectives of Readiness

The past thirty years of clinical experience indicated that most individuals who experienced learning problems began to experience these problems in kindergarten or first grade although they may not have been identified until some years later (Solan, 1982). Educators became aware that failure, or near failure, in kindergarten or grade one negatively affected the way in which a child perceived himself as a student. They believed that those children who had the most difficulty were not ready when they entered school. Thus, much attention was focused on readiness. Developmental psychologists tended to take one of three viewpoints on the question of readiness: (a) maturational (genetic), (b) behavioral (environmental) and (c) cognitive-developmental.

Maturational Viewpoint

Durkin (1972) credited Stanley Hall with playing a major role in shaping the concepts that led to the maturational view of readiness. Hall assumed that the individual

passed through stages of development similar to the evolutionary development of human beings. Thus, development was considered to be predetermined; principally a biological function (Hoskisson, 1977; Mitzel, 1982). To advocates of the maturational perspective, readiness could not be stimulated. One must wait for the appropriate chronological period before the individual was ready for certain tasks. Apparently there was an "inner timetable" which determined the readiness to accomplish things, and any benefits of early stimulation were considered to be relatively temporary. Munn (1974) found that teaching ahead of schedule resulted in only small effects (Crain, 1980). Satz and Friel (1973) claimed that children who lacked the necessary maturation, could progress but at a slower rate than would otherwise be expected.

The solution for children with academic problems was to: (a) delay school entry (Donofrio, 1977; cited in Gredler, 1978), (b) delay the instruction of more difficult curriculum tasks (Ames, 1977), or (c) raise the entrance age (Carlson, 1964; cited in Gredler, 1978). Each of the proposed solutions was intended to reduce the risk of failure by first ensuring that an adequate level of maturity had been reached.

The maturational viewpoint has been criticized on a number of grounds. First, "maturation" was frequently confused with "readiness to learn" and, therefore, was difficult to define and measure (Ausubel, 1961). Second, the maturational perspective disregarded environmental influences. According to Ausubel, instruction must be introduced sometime because maturation alone will not provide the necessary control as in the case of language (Shaw & Costanzo, 1982). Most behavior was seen as being dependent upon both maturation and learning. Third, educators could not stimulate readiness. They must wait for maturity to occur. There has been convincing evidence that teaching difficult concepts at an early age will promote readiness to learn. The television programs Sesame Street and Electric Company, as well as the Western Institute for Science and Technology (WIST) Program for disadvantaged preschoolers has been reported to have produced readiness skills (Mitzel, 1982). Four, there were inherent dangers in the "wait and see" attitude of advocates of the maturational viewpoint. Delays in the introduction of curriculum may be such thay they result in delays in development. Also, educators could attribute insufficient readiness to a maturational lag when in reality it may be their failure to scrutinize the

instructional practices being used. Gredler (1978) emphasized the need to adapt instructional materials to the current level of functioning of the child.

Behavioristic Viewpoint

Behaviorists, in such fields as social learning, behavior modification, learning, and reinforcement, assumed that the environment played a major role in a child's development toward maturation. Advocates of this perspective (Hull, 1943; Guthrie, 1952; Skinner, 1957) believed that one could take any child and have that child develop in ways perdetermined by the modifier. It was assumed that the range of possible outcomes was greater among younger children. The older children had acquired too much uncontrolled environmental experience, thus, were considered more difficult to influence (Mitzel, 1982).

Environmentalists also assumed that readiness was the result of matching reinforcement contingencies with the needs of the child. Reinforcers of food, money, or praise were used to promote some desired change in behavior (Goldenberg, 1978). Environmentalists did realize that one could not expect a child to perform beyond his biological limits.

To advocates of the behavioristic perspective, readiness could be stimulated in the correct environment. One

could not wait for some specified chronological age. Bloom (1964) stressed the importance of early stimulation and manipulation of humans. He claimed that 50% of a child's adult intelligence was attained by the age of four and 80% by the age of eight (Stewart, 1978). Further research by Hunt (1961), Kirk (1968), and Deutsch (1964) revealed that stimulation and manipulation of the environment did cause differences (Goldenberg, 1978).

The current emphasis upon behavioral objectives and criterion-referenced tests is an outgrowth of the behaviorists or environmental view that readiness skills are prerequisite to skills that mark a successful school learner. Supporters of the skills approach emphasized the careful selection of skills which would move the preschooler from his present position toward some predetermined level of competency. The environment, to be conducive for teaching children to learn, was organized and structured with behavioral objectives and criteria that would enable measurement of the degree of learning success (Hoskisson, 1977).

The solution for children with academic problems was to: (a) accurately program tasks that would move children toward more structured and successful learning experiences (Skinner, 1973; cited in Goldenberg, 1978), and (b) carefully

select reinforcers that would match the needs of the children. There seemed to be little remaining doubt in the literature that early stimulation in a structured environment would promote readiness (Newcomer & Magee, 1977). Consequently, the importance of maturation, now an accepted fact of child development, had to permit the inclusion of environmental variables as also having an impact upon developmental outcomes.

There has been some criticism of the behavioristic perspective, particularly with respect to the claim that one could manipulate the environment so that any child would develop according to the predetermined plan. Cognitive theorists (Ausubel, 1961; Bruner, 1960; Piaget, 1969; cited in Shaw & Costanzo, 1982) were strongly opposed to the implications that: (a) children must be taught if they are to learn, and (b) adults needed to control the learning environment to ensure that learning did occur. Although cognitive theorists did believe that stimulating and manipulating the environment did have an effect upon a child's development, they did not view such changes as being permanent. Second, children were viewed as active participants in their own learning, and thus, had control over what they learned and when they learned it. Third, the cognitive

theorists viewed the acquisition of knowledge as a problem-solving endeavour rather than the mastery of a sequence of skills (Hoskisson, 1977).

Cognitive-Developmentalist Viewpoint

The third perspective has been seen as a compromise of the previous viewpoints. Advocates of this view (Bruner, 1960; Kohlberg, 1968; Piaget, 1969; cited in Crain, 1980) assumed that both genetic and environmental factors played a part in development. Supporters of this view also assumed that a child was comprised of organs and systems of action which operated for the purpose of interacting with the environment and the construction of personal experience of himself and the world (Langer, 1969).
Thus, development was dependent upon interaction of the biological, environmental, and self-generated factors.

Cognitive-developmentalists assume that if the genetic and environmental conditions were appropriate, the child would be ready to perform a task provided the child perceived the situation appropriately. According to Piaget (1969), the child alone determined when he was ready to learn (Shaw & Costanzo, 1982). Development was viewed as a process in which the child "strives to maintain continuity in order to conserve his organizational coherence and to

work out the unknown elements he experiences in his environment as he develops" (Hoskisson, 1977, p. 47-48).

Advocates of the cognitive-developmentalist viewpoint believed that a child's maturation could not be accelerated. Development was best promoted in an environment which provided cognitive challenges to active children. Thus, the solution for children with academic problems was to provide challenging materials and allow children to interact with it using their own problem-solving strategies or methods of discovery. The knowledge acquired would be directly related to the child's own readiness to interact and adapt the information to his own internal systems. No external force could determine what was relevant or meaningful to any given child at any given moment, but it is a fact that children of all ages can and do learn. Therefore, cognitive-developmentalists would recommend that adults teach rather than wait to teach. They believe that if the cognitive challenges being presented are beyond the child's current ability, the child will not learn it as the adult may wish, but will learn something from the exposure that is relevant to his current state.

Readiness Assessment

All three of the developmental perspectives previously

mentioned have been evident at some point in the history of early childhood education. Specifically, they became the basis of classroom practices and procedures. Many kindergartens of the 1950's were based upon the maturational viewpoint. Socialization skills were emphasized and children were provided with rich supportive environments in which self-expression was encouraged. The materials and experiences were intended for readiness. During the 1960's, there was increased pressure for accountability and compensatory programs in education. The pressure resulted in behavioral programming within early childhood education. Kindergartens began to emphasize academic learning and external reinforcement in order to meet program goals and objectives. In the 1970's, the impact of Jean Piaget was felt and the cognitive-developmentalist perspective became prevalent in kindergarten programs. Emphasis was placed upon creating environments suitable to the child's level of development. As these changes were occurring in early childhood education, so were methods of assessing readiness undergoing change.

Traditionally, readiness assessment has dealt with academic-process testing (Salvia & Ysseldyke, 1981). Most tests were norm-referenced and measured those abilities

believed to underlie most, if not all, academic skills. Consequently, intelligence and aptitude, thought to underlie all school subjects, frequently were components of a readiness assessment. In fact, tests were devised to predict success in the educational system. They were used to discriminate between those children who were expected to achieve and those who were expected to fail. Changes in special education, however, have dictated changes in assessment practices. For instance, the increased pressure for accountability and compensatory education has resulted in schools requiring a decision orientation other than mere prediction. Reynolds (1975) stated that assessment results should make a difference in the lives of those children assessed.

Two types of instruments have been used in assessments: (a) normative-based tests, and (b) criterion-based tests. Each of these will be examined to determine their value as assessment instruments. Further, three specific procedural approaches have been used to assess preschoolers: (a) readiness tests, (b) rating scales, and (c) psychometric evaluations. Each of these procedures will be examined also in an attempt to determine the most valid and reliable method of determining readiness for school entry.

Types of Instruments

Wendt (1978), after careful examination of normative-based tests, concluded that there were two types. The first he referred to as "normative-categorical". Emphasis was placed upon detecting special needs according to certain diagnostic categories. Intelligence tests, perceptual motor tests, readiness tests, and language tests were of this type.

The "normative-categorical" approach has been criticized on several grounds. First, the separation of children into groups or categories on the basis of test results both pigeonholes and labels children prior to school entry (Anderson, Griffin, & Hunt, 1978). Second, preschool children's rate of growth and development changes so rapidly that the reliability of test results becomes highly questionable (Flynn & Flynn, 1978). Third, this approach may be justifiably criticized by minority groups because of possible biases, especially the intelligence tests which emphasize language development. A fourth criticism dealt with the schools' purpose in assessing readiness. The question raised has been whether schools need to assess readiness or just accept children as they are and educate them accordingly (Gredler, 1978). A fifth criticism stems

from the misclassification of children as ready or not ready for school entry. Misclassification of children has had adverse effects upon how these children view themselves as students. Further, children may be classified as not ready in one school or community but be able to cope in another area. Thus, the school environment in which a child is assessed has a considerable impact upon ultimate placement decisions (Raven, 1981).

The second type of normative-based test Wendt (1978) referred to as "normative-deficit centered". Specific strengths and weaknesses were determined and profiled. Children were classified according to their profile type. Such tests were concerned with measuring auditory reception, visual discrimination, fine motor coordination, vocabulary facility, and like processes. Existing instruments were used in whole or in part to assess particular attributes. Determining specific areas of weakness enabled educators to provide more accurate teaching prescriptions.

Several criticisms of the "normative-deficit centered" approach have been expressed in the literature. First, the use of "cut-off" scores has raised much controversy. Children whose scores fall just above the cut-off point may be in need of special assistance, and conversely, children

whose scores fall just below the cut-off point may receive assistance though they do not require it. Second, categorical labelling does exist even though the negative impact may be less severe than that resulting from the "normative-categorical" type of approach. Third, the relationship between the ability assessment and the prescriptive instruction is a crucial issue, particularly with regard to: (a) the appropriateness of remediation or intervention, (b) the duration of the remediation, and (c) the follow-up procedures. A review of early identification programs directed toward detection and intervention of learning disabilities revealed that the results of this process remain largely inconclusive.

In contrast to the normative types of instruments, which compared the child to group performance, the criterion-referenced instruments were concerned with ordinal matters or level of mastery. Wendt (1978) claimed there were two types of criterion-referenced tests. The first type he referred to as "criterion-academic" in which specific objectives and pupil outcomes were emphasized. Specific academic based skills such as letter recognition, prefixes, suffixes, and number concepts were placed in hierarchical sequences according to order of difficulty. This method

has often been referred to as the "skills orientation" to learning (Hoskisson, 1977; Salvia & Ysseldyke, 1981) and is much in evidence in current education.

The "criterion-academic" approach has been criticized on the basis of the selection of the criterion. Although this method of assessment has not received criticism to the same extent as the normative-based approach, minority groups may still claim cultural bias. Only careful selection of the criterion will minimize the cultural and ethnic bias. A second criticism involves the academic programs at the preschool level. The arguments have been that: (a) children become overly dependent upon the teacher for learning, (b) children learn by rote rather than reason (Evans, 1975), (c) there is discontinuity in the skills approach to learning, and (d) such an approach often disregarded the natural developmental progression of children (Moskovitz, 1968; Weber, 1971; cited in Wendt, 1978).

The second type of criterion-referenced test Wendt referred to as "criterion-cognitive developmental". The focus of this type of approach was on the modalities essential to learning higher order tasks. These processes were ordered both in a sequential and developmental manner. Thus, educators were enabled to determine where a child

was functioning according to his developmental level. Instruction would begin at the identified level. This perspective has been viewed as the "process orientation" (Salvia & Ysseldyke, 1981). Aspects of both the Piagetian and information-processing models have been incorporated.

As the "criterion-cognitive developmental" approach is a relatively recent testing perspective, little criticism has been expressed. With preschool screening becoming an established educational practice and the need for individualized programming within a developmental framework becoming more important, the "criterion-cognitive developmental" method of testing may serve to produce a more unified relationship between assessment and programming.

Readiness Tests

The prediction of readiness for school entry has rested upon the widely accepted notion that current performance is predictive of future achievement. Assessing the current level of functioning of preschoolers in terms of reading, writing, and arithmetic presents a major problem as these children have not yet acquired such skills. Thus, readiness tests were designed to measure those skills thought to be prerequisite to the target task (Nadon, 1983). Predictive validity of these tests was dependent upon: (a)

the degree to which the selected prerequisite task and the target task were related, and (b) the degree to which present performance predicted future achievement. Many readiness tests have evolved (Buros, 1978) and have been studied in terms of their predicted value.

Bremer (1959), in a study involving 2,049 students, reported a correlation of .40 (p=.01) between the Metropolitan Readiness Test (MRT) administered at the beginning of first grade and achievement measured one year later. Stevenson, Parker, Wilkinson, Hegion, and Fish (1976), in their study involving 255 pupils, found similar results. A correlation of .44 for boys and .48 for girls was found between the total scores on the MRT administered at the beginning of grade one and the reading subtest of the Wide Range Achievement Test (WRAT) (p=.01) administered at year-end. Slightly higher correlations were obtained by Mitchell (1962) in his study of 1,170 first grade pupils. Correlations for total readiness on the MRT with achievement as measured by the Metropolitan Achievement Test (MAT) subtests ranged from .51 to .63. Similar results were found by Nagle (1979) in his study involving 176 first-grade children. Correlations on the MRT with later achievement as measured by the Stanford Achievement Test (SAT) ranged from .50 to

.70.

Bremer also conducted a classificational analysis of his data. He found that one third of the children classified as low in readiness actually achieved at the lowest level whereas an equal number of children achieved at an average or above average level. Thus, he concluded that making predictions based upon readiness test scores would result in only a minimal increase in accuracy of detection, in spite of the statistically significant findings. Bremer recommended that the test results be used for diagnostic purposes rather than for placement decisions.

In contrast to the studies cited above, Lessler and Bridges (1973) reported a correlation of .76 between the MRT administered at the beginning of grade one and the California Achievement Test (CAT) administered at year-end. In addition to the MRT, Lessler and Bridges found a correlation of .76 between the Lee-Clarke Reading Readiness Test (LCRR) and the CAT. A classificational analysis of their data indicated that the MRT correctly identified 87.2% of the 148 children who later displayed learning problems and 85.5% of the 145 children who later achieved successfully for a total hit-rate of 86.6%. In comparison, the LCRR correctly identified 77% of the 148 children predicted to perform poorly and

82.8% of the 145 children predicted to perform adequately. The LCRR was slightly less effective than the MRT for prediction of learning problems, however, both tests would seem to be valid screening devices for making decisions regarding placement and compensatory educational needs.

Telegdy (1975) investigated the relationship between three readiness tests and first-grade achievement as measured by the WRAT and the Gray Oral Reading Test (GORT). The readiness tests employed were: The MRT, the Screening Test for Academic Readiness (STAR), and the First-Grade Screening Test (FGST). Significant correlations were found between all predictor variables and criterion variables, however, the MRT was more highly correlated with the criterion variables than were the STAR and the FGST. Similar to the Lessler and Bridges study, correlations coefficients ranging from .58 to .73 were reported. The Letter subtest of the STAR yielded the highest correlation ranging from .62 to .76. Nothing was added to the predictive validity by using the total scores of all predictor variables in a multiple correlation (R's ranged from .64 to .74).

Swanson, Payne, and Jackson (1981), in their study using 179 first-grade children, compared the predictive validity of the MRT and the Meeting Street School Screening

Test (MSSST) with later achievement as measured by the Metropolitan Achievement Test (MAT). The children were divided into two groups to examine the predictive validity of the MRT and MSSST tests. Group I contained 72 students and Group II contained 64 students. Both groups were given all tests. A correlation of .82 for Group I and .84 for Group II between the MRT and MAT were reported. Correlations between the MSSST and MAT were .77 for Group I and .75 for Group II. On the basis of the research, both the MRT and the MSSST would appear to be equally useful as screening devices. The final choice may depend upon the purpose of assessment and the advantage of a group administered MRT or an individually administered MSSST. Flynn and Flynn (1978) suggested that the MRT was a better predictor when used prior to first grade (Colarusso, Plankenhorn, & Brooks, 1980).

Hase (1977), in his study involving 212 kindergarten children, found the First Grade Screening Test to be an effective predictor of grade one achievement (Nadon, 1983). This researcher grouped test items into four subtests: Self-Concept, Visual-Motor, Reasoning, and Vocabulary. These scores as well as the total score were used to identify those children "at risk" for school problems. A

cut-off score of 15 or less on the total test score was used to determine the "at risk" group. This cut-off was in accordance with that recommended by the test authors. Scores established in an earlier pilot study were used to determine those children falling into the moderate to high range on any of the four subtests. The results of the study revealed an 80% agreement between the test classification of "at risk" versus "not at risk" and the teacher ratings of "poor" versus "adequate" in overall school performance. These results were very similar to the hit-rate reported by Lessler and Bridges using the MRT and the Lee-Clarke Reading Readiness Test.

On closer scrutiny, the research data provided by Hase was less favourable than that of Lessler and Bridges. The First Grade Screening Test identified 82.8% of the 189 children who later achieved adequately (true negatives) but only identified 74% of those children who later experienced learning problems. Roughly one child in four or 26% who had later difficulties was missed by this instrument. Further, a horizontal analysis of the data revealed that of those children predicted by teachers to have learning difficulties (N=49) only 17 (35%) actually had difficulty later. Consequently, even if a child were designated as "at risk" on the

First Grade Screening Test, the possibility of later problems would be about 1 in 3. Conversely, if the child were classified as "not at risk" on this test, the chances of not having subsequent problems would be better than 9 out of 10. From the additional analysis, it can be seen that use of no test at all would yield equally satisfactory results. For instance, if we were to predict that 212 children would achieve at an adequate level, we would be correct in 189 cases (89% hit-rate) and would miss in only 23 cases (11%). It is this 11% which is of prime concern; therefore, using no test at all is not a viable alternative.

Conclusions as to the utility of using readiness tests as predictive of later academic achievement must remain tentative. All previous studies reported here revealed significant correlations between readiness test performance and later academic achievement but the correlations varied considerably indicating wide fluctuations in the predictive ability of these tests. Also, there was no consistently uniform results when classificational analysis was used. The MRT was the only readiness test that seemed to be an effective predictor of future achievement, particularly in terms of the proportion of children identified with learning problems (true negatives), the proportion of children "at

risk" who later had learning problems, and the total overall hit-rate.

Teacher Rating Scales

It seems reasonable to expect teachers, who work closely with children over extended periods of time, to be reliable predictors of future achievement. Teachers have the closest and most continuous relationship with children of any school personnel. They also have knowledge of what is relevant to the school system. Keogh, Tchir, and Windeguth-Behn (1974) stated that:

> The kindergarten and primary grade teacher's day-to-day experience...gives her an unequaled perspective for appraising inappropriate or deviant behaviors. She is probably the first professional to observe and compare a child with his peers. It seems reasonable, therefore, to conclude that teachers represent a useful first level screen in the identification of educationally high-risk children. (p. 49)

The majority of recent studies have provided evidence that teachers are surprisingly accurate predictors of future achievement (Cowgill, Friedland, & Shapiro, 1973; Feshbach, Adelman, & Fuller, 1974; Glazzard, 1977; Glazzard, Tollefson, Selders, & Barke, 1982; Keogh, Tchir, & Windeguth-Behn, 1974; Kermoian, 1962; Stevenson, Parker, Wilkinson, Hegion, & Fish, 1976). In fact, many investigators claimed that teachers' evaluations of kindergarten pupils are as good

as, if not better, than standardized test results for placement decisions or predicting future achievement (Colarusso, Mathis, & Shessel, 1977; Glazzard, 1977; Lindsay & Wedell, 1982; Weerdenburg, 1983).

Kermoian (1962), in his study of 276 grade one pupils, found that teachers ratings, after two weeks contact with their students regarding reading readiness, number readiness, and total readiness, correlated .73, .73, and .77 respectively with the same factors as measured by the MRT. Teachers tended to rate higher than the MRT. More than 85% of all teachers estimates fell within one rank of the MRT results. Unfortunately, an attempt to determine which method was more effective for predicting future performance was not undertaken.

Telegdy (1975) compared teacher ratings to readiness test results in an attempt to determine which procedure was more predictive of future achievement. In his study of 56 kindergarten pupils, Telegdy found correlations between teacher predictions and the criterion variables (WRAT and GORT) to range from .35 to .65. This was considerably lower than those reported between the MRT and criterion variables which ranged from .58 to .73. His study indicated that teacher ratings combined with standardized test

procedures would be more beneficial for predicting future performance than using either method in isolation.

Perry, Guidubaldi, and Kehle (1979) investigated the relationship between preschool competencies and later academic achievement. Multiple regression analysis were conducted using kindergarten intellectual, academic, and social variables to predict behavior and achievement in third grade. A sample of 211 kindergarten children were evaluated using the Stanford-Binet Intelligence Scale (Binet), Wide Range Achievement Test (WRAT), teacher ratings of academic readiness, and the Sells Teacher Rating Scale of Peer Relations. The follow-up samples were selected from the remaining 184 children attending third grade. A random sample of 50 was selected and a second sample of 49 was selected from the 61 whose parents had completed questionnaires during the kindergarten year. The results of this study revealed that teacher ratings of affective social characteristics and specific academic measures had equal or higher predictive values than a global measure of aptitude. Unlike previous research, kindergarten teacher ratings of social competence was a better predictor of later school performance than ratings of intellectual abilities and behavior. Corrobrative findings are available in Feshbach, Adelman, and Fuller

(1977) and Stevenson, Parker, Wilkinson, Hegion, and Fish (1976). Independent correlations of social competence Factor I (Kohn Social Competence Scale) with third grade achievement ranged from .43 to .65, whereas, intellectual abilities ranged from .43 to .53 for the random group and .24 to .48 for the questionnaire group and behavior ranged from .25 to .39 for the random group and .29 to .39 for the questionnaire group. The findings that kindergarten teacher ratings of global factors such as school readiness were predictive of future academic performance concurs with recent studies by Flock and Velicer (1977), Stevenson, et al. (1976) and Weerdenburg (1983). Correlations of readiness with third-grade achievement ranged from .36 to .51 for the random group and .38 to .50 for the questionnaire group. Perry and his associates (1979) concluded that teacher ratings of social competencies be included with teacher ratings of academic achievement for the prediction of future school performance.

Teacher ratings were primarily criticized for being: (a) too general, (b) highly subjective, and (c) difficult to replicate. The formalized rating scales became a more sophisticated way of acquiring the desired teacher input. These scales consisted of a number of items categorized

into subtests which were intended to measure more specific aspects of a child's current functioning. It was believed that formalized rating scales would introduce a greater degree of objectivity into teacher evaluations, increase the possibilities of replication, and thus, reduce the extent of teacher bias.

One formalized rating scale that has been used with kindergarten children is the Pupil Rating Scale (PRS) (Myklebust, 1971). The PRS consists of twenty-four items which are grouped into five subscales: auditory comprehension, spoken language, orientation, motor coordination, and personal-social behavior. Each of the items is rated on a scale from one to five with the lower score indicating deficits. The PRS was developed for use with older elementary school children for the purpose of identifying children with learning disabilities. Only recently has the PRS been investigated for its appropriateness in rating kindergarten children.

In a study conducted by Federici, Sims, and Bashian (1976), the correlations between the Meeting Street School Screening Test and the PRS, for high and low risk children combined, was significant at .69 ($p=.01$). The resulting significant difference in means between the two groups

supported the validity of using the PRS at the kindergarten level. Further, the results suggested that the PRS did discriminate between high-risk and low-risk children within the minority group, and that the ratings for both minority samples approximated the ratings for white samples.

Colligan (1979) stated that:

> numerous teacher checklists and screening devices available for such identification purposes are of doubtful reliability and validity because of restricted samples, weak criterion measures, lack of cross-validation, or other faults. (p. 59)

However, Colligan did claim that the PRS was "one well developed checklist for teacher use" (p. 59). Bryan and McGrady (1972) also supported the use of the PRS as an efficient, economical, and reliable instrument for determining children with special needs in the elementary school. Their findings were generally supported by Pihl and Nagy (1980), as well as by Weerdenburg (1983). Evidence on predictive validity, although a limited study, has been provided by Colligan (1979), who found predictive validity coefficients of the scale's subtests against the Stanford Achievement Test (SAT) two years later to be in the range of .53 to .72 ($p=.001$). Colligan's findings confirmed those of Myklebust. On the basis of his study, Colligan concluded that the PRS was a suitable instrument for use

with kindergarten children and the PRS possessed sufficient predictive validity for its inclusion in any battery of tests used to identify children with learning difficulties.

Another rating scale that has been used with kindergarten children is the Student Rating Scale (SRS) (Feshbach, Adelman, & Fuller, 1974). This scale consists of forty-one items and samples cognitive, affective, and social aspects of a child's functioning within the classroom. Similar to other rating scales, the SRS is rated on a scale from one to five with the lower score reflecting a deficit. Feshbach and his associates began their study in 1972 using two large cohorts of kindergarten children (N=888 and 844). These researchers compared the effectiveness of using the SRS rather than expensive, time consuming psychometric procedures for predicting future performance. Results of the correlational analysis at the end of the first grade indicated that the SRS total score and the SRS Factor III (perceptual discrimination) yielded the highest correlations of all the predictor variables. In the Year I sample of 433 children, these two variables correlated .60 with the Gates MacGinitie raw score and .50 and .51 respectively with the Cooperative Primary Test raw scores. The single best predictor in the multiple regression analysis

consistently was the total SRS score.

A follow-up of both cohorts of children was conducted at the end of the third grade. Results revealed a sex difference. Girls had attained consistently higher scores on all achievement tests administered. Consequently, correlational analysis were conducted by sex as well as for the total sample. These results again indicated that the SRS total score was the best predictor. The sex differences noted were: IQ was more highly correlated with achievement for boys than for girls at all grade levels; the SRS total score, as well as all factor scores with the exception of language, were more highly correlated with first grade achievement scores for boys but by the third grade the correlations were higher for girls. Feshbach, Adelman, and Fuller suggested that motivational variables may play a more important role for girls in the early grades and outweigh the influences of IQ. The behavior factors, which indicated poorer performance for boys in kindergarten, probably declined over time with increased maturity. The best predictor for boys across all grades was language (Factor II) with correlations of .41, .40, and .37 with first, second, and third grade reading achievement respectively. For girls, the best predictor was perceptual-motor (Factor V)

with correlations of .37, .45, and .32 with first, second, and third grade reading achievement. Feshbach, Adelman, and Fuller (1977) also suggested that intervening variables such as the home, school environment, and the rapidly fluctuating rate of growth among 5 to 7 year olds may have an impact upon a child's development.

Keogh (1971) emphasized that what a child does is more predictive than what he does not do. While high task performance is indicative of proficiency, poor performance may not indicate a deficiency, but rather, suggest that other intervening variables such as fatigue, malnutrition, lack of motivation, inability to attend or follow directions, to mention a few, are factors (Nadon, 1983).

Feshbach et al. (1974) conducted a classificational analysis to assess the predictive abilities of the SRS as a screening device. Z-scores of -1.25 were used on the SRS as the prediction cut-off score and a grade score of 1.7 as the criterion of "poor reading performance" among first grade subjects. They reported a 17% false positive rate (classified at-risk with no subsequent problems) and a 24% false negative rate (children missed who had problems). The SRS correctly identified 54 of 179 children (30.2%) who later exhibited difficulties and 395 of 406 children (97.3%)

who later achieved adequately. The false positive rate was very small at 2.7%, whereas the false negative rate was extremely high at 69.8%. A similar pattern emerged from the end of third grade follow-up. The overall hit-rate from both analysis appeared rather impressive at 77% and 70% respectively, however, the high false negative rate indicated that the SRS is not an effective predictor of future academic problems.

A number of criticisms of teacher ratings have been reported as follows: (a) teachers may rate girls more accurately than boys (Nadon, 1983; Pihl & Nagy, 1980), (b) teachers lack adequate skills for making accurate judgments (Stevenson, Parker, Wilkinson, Hegion, & Fish, 1976), (c) teacher judgments are too subjective, (d) replication is difficult because descriptors vary from study to study (Colarusso, Plankenhorn, & Brooks, 1980), (e) teachers err on the side of false positives (Gallerandi, O'Regan, & Reinherz, 1982), and (f) teacher responses are largely on negative aspects of a child's personal or social characteristics (Cowgill, Friedland, & Shapiro, 1973; Wells & Peterson, 1978).

Although the early identification of children "at risk" for academic failure is filled with inherent

difficulties, the need for early identification so that preventive measures can be implemented still remains. According to Wells and Peterson (1978), educators

> must always choose between the benefits of early identification and the risk of labeling a child inappropriately, narrowing the range of expectations and responses to him as an individual. (p. 346)

From a review of the literature on teacher ratings, it would seem that such ratings on a "global" or a structured basis, have been reported to be effective predictors of potential learning problems (Federici, Sims, & Bashian, 1976; Keogh & Smith, 1970; Keogh, Tchir, & Windeguth-Gehn, 1976; Nadon, 1983; Stevenson, Parker, Wilkinson, Hegion, & Fish, 1976; Weerdenburg, 1983). Significant correlations of roughly .40 to .70 have been reported between teacher ratings and future academic achievement. A significant correlation between predictor variable and criterion outcome, however, does not imply that a predictive instrument or procedure is suitable for making judgments about the potential ability of a child. Classificational analysis reviewed here have indicated that the instruments failed to identify many children who later experienced academic problems. Possibly manipulation of the cut-off scores of both the predictor and criterion variables would help alleviate

this difficulty, but the real source of the problem would appear to be the overly optomistic ratings by teachers, as well as their hesitance in labeling children as disabled. If, however, a child is rated as likely to experience problems, the chances are about three out of four that he will indeed have problems. The PRS was the only rating scale found to be stable over time and across populations (Pihl & Nagy, 1980). The use of the PRS with kindergarten children was recommended by Colligan (1979).

Psychometric Approaches

Psychometric approaches to prediction have been based upon the notion that knowledge of a child in terms of his overall functioning (i.e., cognitive, physical, social, emotional) will yield data that is predictive of future performance (Nadon, 1983). Assessment of overall functioning has been influenced by two schools of thought, namely, the deficit model and the maturational lag model.

The deficit model implied a causal relationship between some antecedent event and the subsequent behavior. For instance, the child may have a learning problem because he lacked the prerequisite skills. According to Satz and Fletcher (1980), in their review of the literature pertaining to "minimal brain dysfunction", the deficit model has

been widely accepted. Conversely, the maturational lag model holds that children will proceed through all stages of development, albeit some at a slower rate than the average child. No causal relationship was implied by a delay in attainment of specific skills. Much of the literature pertaining to a variety of deficits within learning disabled children, as opposed to normally functioning children, have been largely attributed to maturational lag. The controversy between these two perspectives is not the issue here but rather whether such perspectives have any impact upon assessment procedures. Although assessment procedures may not be directly affected by an examiner's perspective, the interpretation of the data and subsequent recommendations for programming for "at risk" children will vary widely depending upon the underlying theoretical base. The more recent cognitive-developmentalist perspective which emphasized the teaching of children at their current level rather than focusing on deficits or delays, may serve to make the interpretations and recommendations more useful to educators.

A psychometric approach to prediction has made it possible to assess preschoolers. A number of studies have been conducted using psychometric instruments with kindergarten children, both singly and in combination, as indices

of future achievement. An examination of such studies will determine the validity of using psychometric instruments for purposes of prediction. Without establishing predictive validity data, judgments become impossible with regard to: (a) accuracy of the procedure in identifying "at risk" children, (b) the allocation needs for services, and (c) the length these services need to be made available (Book, 1980). Studies that have employed teacher ratings or readiness tests combined with psychometric measures will be examined also.

Investigators have attempted to predict future performance on the basis of measuring a single aspect of development. Variables researched include: visual acuity, auditory acuity, chronological age, sex, intelligence, and perceptual-motor skills. Single variable predictor studies have shown that there is a significant relationship between specific predictor variables and specific achievement variables. However, according to Wallace and Larsen (1978), most authorities agree that the use of single variables is very restrictive when predictions are being made about future academic performance of children (Abrahamson & Bell, 1979; Colarusso, Plankenhorn, & Brooks, 1980; Hopkins & Sitkei, 1969).

Of the many multiple-variable techniques employed to identify children with learning problems, reading readiness tests have been the most researched as has already been indicated. Other researchers have developed extensive predictive indices based upon a combination of variables. The work of de Hirsh, Jansky, and Langford (1966) is probably the most widely known multiple-variable study. de Hirsh and his associates developed their screening index from 37 variables which were intended to identify children at the kindergarten level who were "at risk" of failure in subsequent years. These 37 variables sampled perceptual-motor organization, language development, and readiness to cope with printed symbols. All 37 tests were administered to 53 kindergarten children in this pilot study. The results were later correlated with year-end results of grade two reading. The ten tests which best discriminated between failing and passing readers were selected to form the Predictive Index. In a two-year study (Jansky & de Hirsh, 1972) involving over 400 kindergarten children, a modified form of the Predictive Index correctly identified over 75% of the children who failed in reading at the end of second grade. This final battery, called the Screening Index, was comprised of five tests: letter naming, picture naming,

Gates word matching, Bender Gestalt, and the Binet sentence memory subtest. The multiple correlation between these tests and second grade reading was .66 (Colarusso, Plankenhorn, & Brooks, 1980).

Feshbach et al. (1974) used the de Hirsh index on a sample of 572 kindergarten children to predict grade two reading achievement. Although the index was accurate in 73% of the cases, a high number of false positives was discovered. Similar results were found by Eaves, Kendall, & Critchton (1974) when they used the Screening Index to predict second grade performance of 42 kindergarten children. Seventy-six percent of the cases were accurately identified, but a high number of false positives was also found.

Another well known long-term predictive study was that undertaken by Satz and Friel (1974; 1978). Their study was very strictly controlled and much more extensive than previous investigations. A four-group discriminant function analysis was used to determine the best combination of a set of 22 predictor variables. These variables were longitudinally evaluated with 473 white boys (10% attrition rate) until the end of the fifth grade. Teacher's estimates of reading level was the criterion measure. An extensive analysis of this data revealed that the overall accuracy

of the battery was adequate, but a high number of both false positives and false negatives was evident. "The accuracy of the battery was largely confined to the extreme groups (severe and superior) with the majority of prediction errors occuring in the mild and average groups" (Nadon, 1983, p. 41).

Satz and his associate also conducted stepwise multiple regression analysis to determine the discriminative ranking of the predictor variables. In the first three studies, the top ranking predictor variables were: Finger-Localization, Alphabet-Recitation, and Recognition-Discrimination. Subsequent research with an abbreviated 8 variable test battery developed by Satz et al. was carried out by White, Batini, Satz, and Friel (1979) with similar hit-rates and the errors confined again to the mild and average groups. The overall prediction was 73% (242/332) accurate.

Book (1974, 1980) utilized a progressive screening technique for measures of intelligence, readiness, and perceptual-motor functioning in an attempt to identify "at risk" kindergarten children. Using cut-off scores to form six diagnostic categories ranging from educable mentally retarded to those requiring enrichment, Book found a combination of the Slossan Intelligence Test or the Stanford-

Binet Intelligence Scale, the Bender Gestalt, and the MRT administered to 725 kindergarten children to be highly correlated with end-of-first-grade reading achievement and end-of-second-grade performance. Book's screening procedure correctly identified 82% of the population with a 12% false positive and 23% false negative rate.

Flynn and Flynn (1978) attempted to determine the best combination of tests in a research battery which, when administered to kindergarten children, would give the most accurate prediction of reading achievement. The predictive validity of the Slossan Intelligence Test, Peabody Picture Vocabulary Test, Goodenough-Harris Drawing Test, Developmental Test of Visual-Motor Integration, and the Metropolitan Readiness Test were administered to 123 children in six kindergarten classes. The criterion measure was the California Achievement Test administered in the second grade. A stepwise regression analysis revealed that only the MRT was significantly related to the California Achievement Test total and subtest scores and this relationship was found to account for a mere 10% of the variance.

As pointed out by Nadon (1983), a number of problems arise when attempting to make some generalizations about the literature on psychometric and combined approaches to

assessment. The first problem concerns the high incidence of learning problems as defined by the criterion variable in most of the studies reviewed; in excess of 20%. Such high figures suggest that current definitions of learning problems may be so vague as to be of limited value. Intervention strategies for such a large population would be impractical. Possibly the learning environment or the curriculum should be the focus of attention if 20% to 50% of the population are not adequately achieving. Another alternative would be to establish cut-off scores which would result in the identification of a variety of functioning levels within the group. This procedure would make it possible to more accurately judge the efficiency of predictor variables in terms of the hit-rate for a very specific group as was the case in the study by Satz et al. referred to previously. Also, the elimination of the extreme groups which are easily identified may result in the focus being placed on those groups with the greatest percentage of false positives and false negatives.

A second problem concerns the efficiency of the predictor variables. For instance, a large number of children, who may never exhibit learning difficulties would be screened in and falsely labeled "at risk", while a number

of children, who may later demonstrate learning difficulties, would be missed and falsely labled "not at risk". Advocates for keeping the false positives at a minimum have argued that children falsely labeled "at risk" would become victims of the "self-fulfilling prophecy". Conversely, advocates for keeping false negatives at a minimum reason that children who fall into the false positive category will be quickly identified by their successes and the misclassification rectified without serious side effects. False negatives, however, pose a more serious problem. Those children missed by screening procedures would likely not be identified until they had experienced repeated failure. It is precisely this group that early screening procedures are attempting to successfully identify.

A third problem is associated with the variability among the predictor and criterion variables used in these studies reviewed. Different types of instruments have been employed from teacher ratings to standardized tests with scores based on national, local, school, or specific classroom norms. Also, a variety of scores were used which included: raw scores, z scores, percentile ranks, age equivalent and grade equivalent. Nadon (1983) stressed that "only scores which indicate a child's relative position

in the group (ie. percentiles, z scores, T scores) can be compared with any validity" (p. 50).

A final problem in making generalizations from the research concerns the inability to compare instruments or procedures used. For instance, the procedures included correlational, multi-correlational, simple classificational and discriminant function analysis, and the variables ranged from single variables or instruments to multiple variables and battery approaches. Specific instruments, however, seemed to consistently emerge as valid predictors of future achievement--those which assessed facets of sensory, motor, perceptual, and cross-modal functioning. The research conducted by Satz and his associate revealed that sensory, motor, perceptual, and mnemonic abilities were aspects of the top ranking predictors in their battery as they were in the four top ranking tests of the de Hirsh battery.

Specific Predictive Instruments

Visual-Motor Perception

The importance of visual perception in reading achievement was established by Bryan (1964) in his study involving primary aged children. He claimed that in grade one, visual perception abilities were found to have predictive value for

the following areas of reading: comprehension, readiness, and vocabulary. By grade two, visual perception scores were more predictive of comprehension than vocabulary. At grade three, it was intelligence scores which had the greater predictive utility in terms of reading success. Bryan concluded that tests of visual perception be included in assessments of kindergarten and grade one children, as well as measures of readiness and intelligence.

Larsen and Hammill (1975) reviewed sixty studies to determine whether a relationship existed between certain measures of visual perception and academic learning. The general consensus from the studies reviewed was that visual skills (visual discrimination, visual memory, spatial relations, auditory-visual integration) were essential to academic achievement. School failure had been viewed by many of the researchers as due to a deficiency in visual-perceptual skills. Larsen and Hammill failed to substantiate these assumptions, thus, concluded that there was only a minimal relationship between visual perception and school achievement.

Professionals in the fields of pediatrics, learning disabilities, education, and developmental optometry, by accepting that visual-motor performance is a significant

contributor to academic performance, have employed numerous and varied instruments to assess a child's visual-motor functioning. Two frequently used instruments have been the Developmental Test of Visual Motor Integration (Beery & Buktenica, 1967) and the Bender Visual Motor Gestalt Test (Bender, 1938). Porter and Binder (1981) investigated visual-motor functioning of children between the ages of six and nine using the Bender Visual Motor Gestalt Test (Bender) and the Developmental Test of Visual Motor Integration (VMI). The correlation coefficients between the child's level of visual-motor functioning, as measured by the VMI and the Bender, was significant at .62 (p=.05). However, the coefficient of determination was .38, thus, 62% of the variance was not accounted for. The findings suggested that although the VMI and the Bender do share some common variance, these instruments also measure different constructs. The authors recommended that further research was required to determine what other factors are present in these instruments. Lehman and Breen (1982) also investigated visual-motor functioning of 125 primary aged school children using the VMI and the Bender to determine whether these two instruments in fact measured identical skills. Their findings concur with those of Porter and Binder (1981).

In a longitudinal study, Reynolds, Wright, and Wilkinson (1980) examined the predictive validity of the Test for Auditory Comprehension of Language (TACL) and the VMI with 89 kindergarten children. These two tests were examined independently and in combination. The inclusion of both a verbal and a nonverbal measure in a screening battery has been a frequent recommendation in the literature (Koppitz, 1975; Reynolds, 1978). It was inferred that accuracy of prediction would increase when both measures were employed rather than only one instrument. All children were administered the SRA Achievement Series in a two year follow-up which yielded a total composite score in addition to subscores in Reading, Mathematics, and Language Arts. Both instruments showed moderate correlations with the criterion measure over the two years (.54 and .53, respectively; p= .001). The proportion of the variance accounted for did not appear to be of any great practical value.

Keogh and Smith (1970) investigated the predictive utility of the Bender and the teachers' ratings to discriminate between "high risk" and "high potential" children. During the kindergarten year, teachers rated the children on a five point scale of reading readiness from "totally lacking in reading abilities" to "ready to begin now".

The criterion measures were the Stanford Reading Test in grade two and the California Achievement Test in grades three to five. A combination of the Bender scores and the teacher ratings yielded correlations ranging from .61 to .71 ($p=.05$). Early identification appeared to be more accurate for the high potential than the high risk child, suggesting that children who were successful on the Bender tended to be successful achievers throughout the school years.

Buckley (1978) reviewed the literature pertaining to the use of the Bender Visual Motor Gestalt Test as a psychometric instrument for predicting future academic performance. He reported that over an eleven year span (1966-1977), there had been no conclusive evidence that the instrument was an effective predictor of school achievement. Many of the studies failed to confirm its use as a valid predictor of academic performance with the kindergarten, primary, and upper elementary populations (Blakslee, 1972; Connor, 1968-1969; Coy, 1974; Edmunds, 1970; Keogh, 1965; Keogh, 1967; Paul, 1971; cited in Weerdenburg, 1983, p. 37).

Weerdenburg (1983) examined a variety of instruments in an attempt to determine the best combination of tests for predicting future achievement. Both the Bender Visual

Motor Gestalt Test (Bender) and the Developmental Test of Visual Motor Integration (VMI) were included as measures of visual-motor functioning. The VMI yielded correlations of .442 and .357 with Reading (report card mark) and Mathematics(report card mark) respectively, whereas, the Bender yielded correlations of .331 and .247 with Reading and Mathematics (report card marks) respectively. The VMI accounted for 24.5% of the variance using the Metropolitan Readiness Test visual score as the criterion measure. The Bender did not contribute to the predictive model at the .05 level of significance.

In summary, Bryan (1964) emphasized the need of assessing visual perception at the kindergarten and grade one levels along with reading readiness. However, the review of the literature pertaining to visual perception has revealed divergent findings. Larsen and Hammill (1975) did not attribute any significance to visual perceptual performance. Reynolds, Wright, and Wilkinson (1980) had no use for the Developmental Test of Visual Motor Integration, whereas, Weerdenburg (1983) found the Developmental Test of Visual Motor Integration to be of some utility but not the Bender Visual Motor Gestalt Test. A review of the literature on visual perception by Buckley (1978) indicated that no

conclusive evidence was found that the Bender can effectively predict future achievement. Keogh and Smith (1970) reported that the Bender, when administered to kindergarten children, is predictive of achievement at the sixth grade level. Both studies by Porter and Binder (1981) and Lehman and Breen (1982) revealed that the Bender and the VMI measure different constructs besides visual-motor integration, and thus, can both be utilized in a screening battery.

Auditory-Visual Perception

With the claim that instruments which measure sensory, motor, perceptual, and cross-modal functioning have consistently emerged as predictors of future achievement (Nadon, 1983), it would seem reasonable that the best of such instruments be included in any psycho-educational battery used to assess readiness for school entry. Koppitz (1977) emphasized the importance of including measures of intersensory integration, sequencing, and recall in a meaningful psychoeducational battery. She defined intersensory integration as involving the integration of two different sense modalities (ie. visual stimuli and oral recall), whereas, intrasensory integration involved both stimuli and responses being given in one sense modality (ie. visual stimuli and written recall; aural stimuli and oral recall).

In the earliest studies of Birch and Belmont (1964), 150 poor readers and 50 average readers from kindergarten to grade six were examined to determine cross-modal functioning abilities. The authors hypothesized that children with reading problems experienced impairment in the visual-auditory channels. Results of their study revealed that children with reading problems had difficulty in transferring from one modality to another, and children who were good readers received higher auditory-visual integration scores than did the poor readers. Similar results were found by Beery (1967) using both auditory-visual and visual-auditory tasks with older eight to thirteen year old children.

Muehl and Kremenak (1966) investigated the relationship between prereaders' abilities to integrate sensory information and their reading achievement. The four matching tasks employed were adaptations of those used by Birch and Belmont (1964). All possible combinations of both intersensory and intrasensory integration involving the auditory and visual channels were provided. The visual-visual tasks were found to be the easiest, whereas, the auditory-auditory tasks were the most difficult. Both the auditory-visual and visual-auditory tasks were found to be significant

independent predictors of grade one reading achievement; with the former being the better predictor.

Whiton, Singer, and Cook (1975) investigated the importance of auditory-visual intrasensory integration as compared to audiovisual cross-sensory integration skills for reading acquisition in 64 first grade boys. The results supported their hypothesis that the ability to process information across different modalities was an important skill for reading acquisition.

Reilly (1971) examined the relationship between auditory-visual integration and sex, as well as reading success, using 225 pupils from grade one to four. The findings revealed that auditory-visual integration ability was more closely related to comprehension scores than vocabulary. Further, Reilly concluded that auditory-visual integration ability occurs in stages which generally concurs with the findings of Birch and Belmont (1964). Reilly also found that auditory-visual integration skills developed earlier in girls but leveled off by grade four. Boys' levels of auditory-visual integration ability, however, reached significance by grade two. Based upon these findings, Reilly recommended that auditory-visual integration skills be taught to males at the preschool level.

Derevensky (1977) reviewed literature related to the relationship between cross-modal functioning and reading performance. He noted that, between the ages of five and seven, the "character, integration, and inter-relationship of the various sensory systems' undergo a significant series of changes. According to Satz and Friel (1964), these sensory skills develop rapidly during this age period. The development of such sensory integration skills seemed to Derevensky to be an important prerequesite for formal learning. Thus, he concluded that the interrelatedness and acquisition of the auditory and visual modalities were essential to the reading process.

Katz and Deutsch (1964) investigated auditory and visual learning and related it to levels of reading and age. Auditory, visual, and auditory-visual tasks were administered to 48 boys in grades one, three, and five. The subjects were classified as either good or poor readers. The criterion measure used was the Gates Advanced Primary Reading Test administered to all third and fifth grade boys. The results of the analysis of variance revealed that: (a) good readers remembered more items than did the poor readers, (b) all subjects had the most difficulty with auditory memory items, and (c) both good and poor readers had almost

equivalent performance on visual learning tasks. These findings were most evident among the first grade group. Consequently, Katz and Deutsch stressed the importance of early diagnosis of reading problems, as well as recommending that primary grade pupils receive additional training in attending to auditory stimuli.

Weerdenburg (1983) explored a number of instruments thought to have predictive value when used with kindergarten children. The Visual Aural Digit Span Test, Pupil Rating Scale, Developmental Test of Visual Motor Integration, Human Figure Drawing, Evanston Early Idenfification Scale, Bender Visual Motor Gestalt Test, and a 'global' Teacher rating were administered to 85 subjects in May of their kindergarten year. The criterion measures were: (a) Reading report card mark, (b) Mathematics report card mark, (c) a 'global' Teacher Rating in grade one, and (d) the Metropolitan Readiness Test. The results revealed that the Visual Aural Digit Span Test Total Score was the best predictor variable accounting for 42.2% of the variance with the Reading report card mark. Thus, the author concluded that intersensory integration, sequencing, and recall processes, which were measured by the Visual Aural Digit Span Test, were important in predicting academic readiness for first grade.

In summary, the research indicated that both intersensory and intrasensory integration abilities were important for acquisition of reading achievement (Birch & Belmont, 1964; Beery, 1967; Derevensky, 1977; Muehl & Kremenak, 1966; Weerdenburg, 1983). Katz and Deutsch (1964) reported that cross sensory integration was important in grade one but that poor auditory perception was indicative of poor readers by the third and fifth grade.

Summary

In summary, readiness tests, rating scales, visual-motor perception, auditory-visual integration measures have been employed in the past to assess the readiness of kindergarten children for the academic demands of grade one. The Metropolitan Readiness Test (MRT) has been shown to be the only readiness instrument that is an effective predictor of future achievement, particularly in terms of the proportion of children correctly identified as "at risk" and "not at risk" for academic problems. The 1976 edition of the MRT supports moderate validity data (Nagle, 1979; Swanson, Payne & Jackson, 1981), and thus seems warranted in a prediction battery to determine academic readiness.

The Pupil Rating Scale (PRS) has been used extensively with young school children and has been considered to be

stable over time and across populations (Colligan, 1979). Its use with kindergarten children was substantiated by Colligan (1979) and Weerdenburg (1983). The PRS possesses sufficient predictive validity to be included in any test battery used to determine future performance.

Assessment of visual-motor performance with kindergarten and grade one populations has been considered an important factor in determining readiness for grade one (Bryan, 1964). The Bender Visual Motor Gestalt Test and/or the Developmental Test of Visual Motor Integration frequently have been employed in the past with conflicting results as to their use in a kindergarten test battery. Therefore, either of these instruments may be used in a screening battery.

The importance of auditory and visual integration processess has been emphasized in the acquisition of reading skills (Derevensky, 1977; Reilly, 1971; Whiton, Singer, & Cook, 1975; Weerdenburg, 1983). Koppitz (1977) recommended the use of the Visual Aural Digit Span Test to assess intersensory integration, sequencing, and recall with school beginners because it correlates well with reading, spelling, and mathematics. This instrument, although relatively recent, has been used with some success (Weerdenburg, 1983).

Although there is little agreement among researchers as to the best method to be used to obtain information necessary for identification, the concept of early identification as a preventive measure for children with potential learning problems is considered valuable, therefore, worthy of continued research in spite of the current problems.

CHAPTER III

RESEARCH DESIGN AND PROCEDURE

The Sample

The subjects were obtained by approaching the Edmonton Public School Board for permission to conduct research pertaining to the prediction of grade one achievement from measures of readiness, teacher ratings, visual-motor perception, and auditory-visual perception. A sample size of 235 children between the ages of 61 and 82 months upon entrance to kindergarten were obtained for this study. The sample was limited by the exclusion of those children with severe physical or mental disabilities, such as blindness, deafness, cerebral palsy, mental retardation, as well as children where English was a second language. The rationale for excluding this former segment of the population was that children with these conditions were rarely misclassified in an assessment or had been identified much earlier in their lives. The latter group was excluded because the instruments required a command of the English language, therefore, results would be biased.

Nine schools in various parts of the city of Edmonton took part in this study. One school dropped out of the study after the first year. These schools were selected

for their ability to provide kindergarten children.

Letters outlining the nature of the study, together with consent forms, were sent to parents of the kindergarten students requesting permission for their children's participation. (Appendix A)

Instruments

Metropolitan Readiness Test (MRT) (Nurss & McGauvran, 1976)

The Metropolitan Readiness Test was originally designed to assess a child's readiness for formal reading instruction. There are two levels of the revised 1976 edition: Level I for use during the first half of the kindergarten year and Level II used during the latter half of kindergarten or beginning of first grade. The MRT can be easily and effectively administered by the kindergarten teacher without any special training. The administration time takes about 80 minutes.

The MRT, Level I is composed of six subtests purported to measure basic skills needed in beginning reading and arithmetic and yields scores for separate subtests, two skills areas, plus a composite score. The subtests are: Auditory Memory, Rhyming, two visual (Letter Recognition and Visual Matching), and two language (School Language and

Listening and Quantitative Language). Children respond to teacher instructions (oral) by marking with a pencil an appropriate box in the test booklet.

The MRT was selected for use in this study because of its wide use and established reliability and validity. The split-half reliability reported in the manual was .94 and the alternate form reliability was .87. The manual reports validity studies which indicate correlations of .70 and .69 were obtained between the MRT Total Score and the Stanford Achievement Test, respectively. These validity studies were obtained during the first grade. Review of the literature does support the use of the MRT at the kindergarten level (Flynn & Flynn, 1978).

Pupil Rating Scale (PRS) (Myklebust, 1971)

The Pupil Rating Scale was originally designed as a screening device for learning disabilities to be used by the classroom teacher. It consists of 24 items grouped into five subtests: Auditory Comprehension and Memory, Spoken Language, Orientation, Motor Coordination, and Personal-Social Behavior. The items within each of the subtests comprise specific observable behaviors to be rated by the teacher on a scale from 1 to 5 (poorest to best performance, respectively). The ratings are clearly defined in behavioral

terms for each item. A verbal score may be obtained by combining the first two subtests and a nonverbal score is derived from a combination of the latter three subtest scores.

The PRS was normed on 2,176 third and fourth grade students. The means and standard deviations for the five subtests, verbal subtotal, nonverbal subtotal, and grand total are presented by grade, sex, and group (borderline, learning disabled, normal control). Thus, the PRS can yield eight separate scores for analysis.

The PRS manual (Myklebust, 1971) contains information regarding reliability and validity through correlation and discriminant analysis with the data obtained from cognitive, achievement, and psychoeducational variables. Correlations between the items on the scale for the Total PRS score ranged from .64 to .98. The correlations between ratings and each of verbal, spatial, perceptual, and nonverbal intelligence ranged from .10 to .35. Correlations between ratings and academic achievement (word knowledge, word discrimination, reading, spelling, and arithmetic) ranged from .06 to .53. All correlations were significant at the .05 level. The PRS showed the strongest relationship with reading, spelling, and arithmetic. The use of discriminant

analysis with 49 psychoeducational variables revealed that the PRS can differentiate between good learners and learners having minor difficulties (F=55.78, p=.01).

The PRS was selected for use in this study because it can be used with kindergarten children (Weerdenburg, 1983). Further, by excluding cases destined to have severe learning problems, the current study is aiming at detecting those pupils with minor deficiencies which historically have been most difficult to identify. The PRS, then, becomes an important instrument for this study.

Visual Aural Digit Span Test (VADS) (Koppitz, 1977)

The Visual Aural Digit Span Test was originally designed to measure aural and visual short-term memory of children between the ages of 5.6 years to 12.11 years and to provide information about intersensory and intrasensory integration. The VADS is appropriate for use from the end of kindergarten up to the sixth grade. The end of kindergarten has been recommended because the test assumes that children are able to read and write digits. The time for administration is approximately ten minutes. Children are required to hear and see the stimuli and respond orally or in writing.

The VADS consists of four subtests that measure short-

term memory of a series of two to seven digits. The subtests are as follows:

(1) Aural-Oral (AO) measures integration of auditory perception, sequencing, and recall

(2) Visual-Oral (VO) measures visual oral integration, sequencing, and recall

(3) Aural-Written (AW) measures auditory-visual integration, sequencing, and recall

(4) Visual-Written (VW) measures intrasensory integration, sequencing, and recall

Scoring is a relatively simple procedure. The score given for each subtest equals the longest digit sequence successfully completed without error. The highest possible score that can be achieved on any subtest is 7. Eleven different scores may be obtained from the VADS Test. Four scores are derived from the four subtests. Additional scores are derived from a combination of subtest scores as follows:

VADS Combination Scores

(5) Aural Input or AI (AO & AW)

(6) Visual Input or VI (VO & VW)

(7) Oral Expression or OE (AO & VO)

(8) Written Expression or WE (AW & VW)

(9) Intrasensory Integration or Intra (AO & VW)

(10) Intersensory Integration or Inter (VO & AW)

(11) Total VADS Test Score or Total (AO & VO & AW & VW)

Test-retest reliabilities were reported for two groups of children with learning and behavior problems. Subjects were 35 six to ten year olds and 27 eleven and twelve year olds. The interval between tests ranged from one day to fifteen weeks. Correlations between the eleven possible scores ranged from .74 to .92 and .72 to .90 respectively for each group ($p < .001$). The Total Test Score had the highest reliability in each group. Thus, the VADS Test scores appear to be reliable over a three to four month period.

Validity data was reported (Koppitz, 1977) for the VADS Test administered at the end of kindergarten with third grade achievement scores. It was apparent that the VADS Test performance of the four learning disabilities groups was closely related to their level of achievement with one exception; the Aural-Oral subtest. The Aural-Oral subtest failed to show significant correlations with any of the three achievement measures (Wide Range Achievement Test Subscores). With a few minor exceptions, all correlations between the other 10 VADS Test measures and

the achievement measures were statistically highly significant at the .05 level or better.

Developmental Test of Visual Motor Integration (VMI) (Beery & Buktenica, 1967)

The Developmental Test of Visual Motor Integration is a form-copying test consisting of twenty four geometric designs arranged in order of increasing difficulty and can be administered to children between the ages of two and fifteen years. The test was designed to measure aspects of a child's visual-motor functioning including visual-motor perception, visual-motor integration, fine motor control. The VMI can be group or individually administered. It takes about ten minutes to administer and minimal training is required. Subjects are asked to copy the designs without: (a) tilting the booklet, (b) erasing, or (c) reworking the designs.

The scoring system is simply to check each design drawn against a well illustrated set of criteria and scored as either "pass" or "fail" until three consecutive errors occur. Raw scores are determined by tallying the number of forms passed before three successive errors occurred. The total raw score is converted into a developmental-age equivalent, with separate tables for boys and girls.

The concurrent validity of the test is reported as satisfactory (Sattler, 1982). Using such criteria as chronological age, reading achievement, mental age, perceptual skills, and psycholinguistic skills, the correlations were .89, .50, .38 to .59, .80, and .20 to .81 respectively. The concurrent validity results show that the VMI was more highly correlated with reading and other academic achievement tests for the primary grades than for the upper grades (.51 to .73) (Weerdenburg, 1983).

Test-retest reliabilities with intervals of two to eight weeks ranged in the low .80's, while internal consistency reliabilities ranged from the low .70's to low .90's. Interrater reliabilities were reported to be from .66 to .93 in the manual (Beery, 1982).

Stanford Achievement Test (SAT) (Madden, Gardner, Rudman, Karlsen, & Merwin, 1973)

The Stanford Achievement Test is a norm-referenced and "objective referenced" test designed to assess skill development in several academic content areas. Three forms of the test A, B, C are available at six levels from grades 1.5 to 9.5. A lower level of the SAT, the Stanford Early School Achievement Test, is appropriate for children in kindergarten and first grade. The SAT is comprehensive in nature.

measuring knowledge, skills, and understandings believed to be components of an elementary school curriculum.

The SAT, Form A, Primary Level I consists of seven subtests: Vocabulary, Reading Comprehension, Word Study Skills, Mathematics Concepts, Mathematics Computation, Spelling, and Listening Comprehension. Children respond to oral instructions given by the teacher by marking with a pencil an appropriate circle beside the answer in a test booklet. Total administration time takes about 190 minutes. The SAT manual does recommend that the test be administered in smaller time slots according to the pupils ability to attend.

A variety of transformed scores are obtained for the SAT: stanines, grade-equivalent scores, percentiles, age scores, and various standard scores. The test may be scored by hand or machine scored. The manual contains an answer key for hand scoring.

The SAT was selected for use in this study as a criterion measure because of its excellent reliability and validity. Both the split-half and the Kruder-Richardson Formula 20 reliability coefficients are generally high (only 30 below .80 in the Primary I and II levels) with the majority between .85 and .95. The validity of the SAT

rests primarily on its content validity. Items were evaluated and edited by the subject matter experts, measurement experts, and minority group representatives. Empirical validity rests upon (1) increased item difficulty with higher grade levels, and (2) a moderate to high relationship with previous SAT's as well as with current and previous Metropolitan Readiness Tests.

Procedure

Initially, a letter describing the intent and proposed design of this study was sent to those principals of the Edmonton Public Schools who had expressed an interest in participating. (Appendix A) Letters, together with consent forms, were sent to parents of kindergarten children outlining the nature of the study, ethical considerations, and requesting permission for their children's participation. A follow-up meeting with the principals and affected staff (kindergarten and first grade teachers) were scheduled in each of the participating schools to discuss what was required of both staff and students, as well as to answer any questions which arose. Children with severe physical or mental disabilities (blindness, deafness, cerebral palsy, mental retardation), as well as children where English is the second language, were excluded from this study. The

rationale for excluding children with these conditions has been stated previously (see The Sample, p. 69).

Administration of the Instruments

Kindergarten teachers were asked to prioritize a list of the most important readiness factors they believed to be essential to school success and submit it to the researcher by November 30, 1985. These teachers were not provided with any specific criteria on which to base their list. During April, 1986, the kindergarten teachers were asked to complete the Pupil Rating Scale for each child for whom permission to participate had been obtained. Teachers were asked not to compute the item ratings. All computations were done by the researcher to avoid risk of errors. It was explained to the teachers how they were to rank each PRS item in accordance with the manual specifications. They were encouraged to utilize any observed behaviors since school commencement. The PRS was administered prior to the administration of the Metropolitan Readiness Test to avoid influencing ratings through test observations. Finally, kindergarten teachers administered the Metropolitan Readiness Test to each subject during May, 1986 in small group settings. Administration followed training in correct administration procedures according to the manual to ensure

reliable and valid data were obtained. The MRT also was scored by the researcher to prevent errors.

Arrangements were made with the kindergarten teacher for a graduate student to administer both the Developmental Test of Visual Motor Integration and the Visual Aural Digit Span Test to each subject individually during April or May 1986. Administration of these tests was in accordance with the manual specifications. Graduate students were trained in the administration of these tests prior to entering the schools. The VMI was scored by an experienced school psychologist and the VADS by the researcher to prevent errors.

In the follow-up assessment at the end of grade one, the first grade teacher was asked to administer the Stanford Achievement Test to all subjects in small group settings during April or May 1987. Administration followed training in correct administration procedures according to the manual to ensure both reliable and valid data were obtained. Further, information on academic achievement was obtained from the cumulative records on each subject (Edmonton Public School Board Mathematics and Reading scores).

Statistical Procedures

The data collected for this study first were subjected

to a descriptive analysis. The means, standard deviations, and intercorrelations for all variables were computed for the total group and separately by sex. Second, kindergarten teacher readiness factor lists were subjected to a frequency analysis to determine the most prevelent factors. Third, multiple regression analysis was used to determine whether using the variables in multiple correlation would significantly add to the amount of explained variance or whether they were redundant. Finally, discriminant function analysis was used to clarify where prediction errors would occur given a certain set of criteria.

Delimitations of the Study

1. Data were collected only from kindergarten children who did not display severe mental, physical, or language deficits thus limiting the generalizability to all other kindergarten children.

Limitations of the Study

1. A volunteer sample was used making this study subject to the limitations of volunteer research (Rosenthal & Rosnow, 1975).

2. The age range from five to seven is one of transition (Jansky & de Hirsch, 1972). Piaget claimed that children of this age move back and forth between

preoperational and concrete stages of development (Piaget, 1969).

> Fluctuations in emotional, social, home environment and/or physical variables may affect the child's performance on a battery of tests with kindergarten age children. (Weerdenburg, 1983, p. 113)

3. No attempt was made to monitor the effectiveness of a teacher. This variable was beyond the scope of this study.

4. A replication of the Kindergarten Teacher Readiness Constructs with a larger teacher sample would enable a researcher to compare individual teachers' prediction and the total data with the Pupil Rating Scale constructs.

5. A multiple regression analysis procedure was used as the best procedure to analyze those questions pertaining to predictive validity of the test battery. However, too much variance remained unexplained in the predictor variables. The question to be answered is: What extraneous variables may influence readiness for school entry?

CHAPTER IV

RESULTS

The results are reported following the traditional procedure, which includes restatement of the research questions, the pertinent statistics, and the appropriate conclusions. A two-year longitudinal study was conducted, resulting in two sets of data. For clarity in reporting, the kindergarten results will be referred to as Year I results and grade one results will become Year II results.

Descriptive Statistics

A listing of the abbreviations used for predictor and criterion variables, as well as a summary of the descriptive statistics of all variables, is reported in Appendix B. This appendix includes the number of subjects in the study, and the means and standard deviations of all variables presented in Table A. Table B states the means and standard deviations for the total group and separately by sex. No significant differences were found between the sexes.

The number of subjects varied. The total number of subjects in Year I for which complete test scores were obtained was 235 (131 males and 104 females). There was a considerable reduction in Year II. The total number of subjects was 112 (62 males and 50 females). The mean age

at kindergarten entrance was 69.3 months with a standard deviation of 3.01.

The Pearson product moment correlation coefficents between the predictor variables and criterion variables are presented in Appendix C. Analyses of the data revealed that the highest correlation in Year I data was between the criterion Metropolitan Readiness Test--Composite Score (MRTC) and the Pupil Rating Scale--Verbal Score (PRSV). This correlation was .615. It was followed by a correlation of .603 between the MRTC and the Visual Aural Digit Span Test--Total Score (VADS). Also, yielding a high correlaion of .602 to the criterion MRTC was the Pupil Rating Scale--Spoken Language (PRSS). Next in order was a correlation of .584 between the MRTC and the Auditory Input (AI) subtest of the VADS. The criterion MRTC also yielded a correlation of .579 with the Pupil Rating Scale--Total Score (PRST).

Higher correlations were obtained when the MRT test became a predictor variable in Year II. Analyses of Year II data revealed that the highest correlation was between the criterion Stanford Achievement Test--Auditory Subscore (SATA) and the predictor MRTC. The correlation was .744. Also yielding a high correlation .726 to the criterion Stanford Achievement Test--Total Score (SATT) was the MRTC.

This was followed by a correlation of .679 between the criterion Stanford Achievement Test--Mathematics Subscore (SATM) and the MRTC. Next in order was a correlation of .624 with the criterion SATA and the MRT--Language Score (MRTL). Other correlations also reached the .001 level of significance.

Multiple Regression Analyses

A multiple regression analysis was computed for the total twenty predictor variables with the nine criterion variables used in Year I of the study. Twenty-nine predictor variables and six criterion variables were employed in Year II of this study. Also, total tests were analyzed separately from the subtests to eliminate any redundancy. The purpose of this statistical procedure was to (1) eliminate all predictor variables that were not significant at the .05 level, and (2) obtain the most efficient test battery for each criterion. The six significant predictor variables for kindergarten (Year I) were: Visual Aural Digit Span Test--Total Score (VADS), Pupil Rating Scale (PRS)--Total Score (PRST), Developmental Test of Visual Motor Integration (VMI), PRS verbal score (PRSV), Aural Input (AI) subtest of the VADS, Oral Expression (OE) subtest of the VADS. Nine significant predictor variables

were found for grade one (Year II) They were: Metropolitan Readiness Test (MRT)--Composite Score (MRTC), PRST, VADS, PRSV, AI, Intra-sensory Integration (INTRA) subtest of the VADS, MRT--Quantitative Score (MRTQ), MRT--Verbal Score (MRTV), MRT--Rhyming Score (MRTR). The abbreviations of these tests and predictor variables will be used throughout this chapter.

Research Questions

Predictive Accuracy of Single Tests

The first three questions involved the predictive accuracy of using a single test from the battery to predict grade one achievement.

Question 1. What percentage of the variance is accounted for by using the PRS to predict grade one achievement?

Question 2. What percentage of the variance is accounted for by using the VMI to predict grade one achievement?

Question 3. What percentage of the variance is accounted for by using the VADS to predict grade one achievement?

Table 1 shows the percentage of the variance accounted for if each of the predictor tests were used singly to predict grade one achievement. First, the VADS test accounted for 36.4% of the variance. This was followed by the PRS which accounted for 33.5% of the variance when used

TABLE 1

THREE SEPARATE PREDICTOR TESTS WITH

THE METROPOLITAN READINESS TEST

Variable	r	R^2	% Variance Accounted For
VADS	.603	.364	36.36
PRST	.579	.335	33.52
VMI	.455	.207	20.70

singly. Finally, the VMI accounted for 20.7% of the variance. More than 60% of the variance was unexplained on the best of these measures. Prediction based upon the results of any one of these tests would be unreliable.

Question 4. What percentage of the variance is accounted for by using the MRT to predict grade one achievement?

The MRT became a predictor variable in Year II of this study. Table 2 shows the percentage of variance accounted for by using the MRT to predict the criteria: Stanford Achievement Test--Auditory Subscore (SATA), SAT--Reading Subscore (SATR), SAT--Mathematics Subscore (SATM), SAT--Total Score (SATT), Edmonton Public School Reading Test (EPSR), and Edmonton Public School Mathematics Test (EPSM). Results revealed that using the MRTC to predict the SATA accounted for 56.8% of the possible variance, whereas using the MRTC to predict the SATT accounted for 52.7% of possible variance. Next, the MRTC accounted for 34.8% of the variance when used with the criterion, EPSR. Using the MRTC to predict the criterion SATR accounted for 34.7% of the variance. The MRTC accounted for only 16.5% of the variance when used to predict the EPSM criterion. Although the MRTC is the best single predictive instrument, the percentage of unexplained variance ranged from 43.2 to 83.5 for

TABLE 2

METROPOLITAN READINESS TEST WITH

SIX CRITERION VARIABLES

Criterion Variable	Mult. R	R^2	% Variance Accounted For
SATA	.753	.568	56.78
SATR	.589	.347	34.69
SATM	.679	.461	46.10
SATT	.726	.527	52.71
EPSR	.590	.348	34.81
EPSM	.406	.165	16.48

the six criteria. This suggests that the MRTC may account for more variance when combined with other predictive instruments.

Predictive Accuracy of the Total Test Battery

Question 5. What is the percentage of accuracy of predicting grade one achievement using the entire test battery?

A multiple regression analysis of the Year I predictor tests with the Metropolitan Readiness Test Composite Score (MRTC) is reported in Table 3. The first variable to enter the model was the VADS, accounting for 36.4% of the variance, followed by PRST, which raised the percentage of variance to 47.3. When the VMI was added to the equation, the percentage of variance was raised to 50.5. The variables were significant at the .01 level.

Tables 4, 5, and 6 present the multiple regression analyses of the Year II predictor tests with the Stanford Achievement Test, the Edmonton Public School Reading Test, and the Edmonton Public School Mathematics Test. The Metropolitan Readiness Test became a predictor variable for Year II of the study. Table 4 shows the MRTC entered

TABLE 3

MULTIPLE REGRESSION ANALYSIS OF THREE PREDICTOR VARIABLES WITH THE METROPOLITAN READINESS TEST COMPOSITE SCORE YEAR I (N=235)

Step	Predictor Variable	F Value	Mult. R	% Variance Accounted For	% Added	R^2
1	VADS	133.30 *	.603	36.39	-	.364
2	PRST	104.23 *	.688	47.33	10.94	.473
3	VMI	78.44 *	.710	50.46	3.13	.505

* $p < .01$.

TABLE 4

MULTIPLE REGRESSION ANALYSIS OF FOUR PREDICTOR VARIABLES WITH STANFORD ACHIEVEMENT TEST--YEAR II (N=112)

Step	Predictor Variable	F Value	Mult. R	% Variance Accounted For	% Added	R^2
1	MRTC	128.49 *	.734	53.88	-	.539
2	VADS	75.04 *	.761	57.93	4.05	.579
3	PRST	54.91 *	.777	60.40	2.47	.604

* $p < .01$.

the model first, accounting for 53.8% of the variance. The next variable to enter was the VADS, which raised the percentage of variance to 57.9. When the PSRT was added to the model, the percentage of variance accounted for became 60.4. These variables, also, were significant at the .01 level. All tests are predictive of the Stanford Achievement Test, except the VMI, which did not enter the model as a significant factor.

Table 5 reports the multiple regression analysis of the predictor tests with the Edmonton Public Reading Test (EPSR). The first variable to enter the model was the MRTC, accounting for 35.5% of the variance. The next variable to enter was the PRST, which raised the percentage of variance to 42.2. Both tests are significant at the .01 level. Neither the VADS nor VMI tests entered the model as predictors of the EPSR.

A multiple regression analysis of the predictor tests with the Edmonton Public School Mathematics Test (EPSM) is reported in Table 6. Only one variable entered the model. The VADS accounted for 19.4% of the variance, significant at the .01 level. None of the other tests in the battery were predictive of the EPSM.

In summary, Table 7 summarizes the data relating to

TABLE 5

MULTIPLE REGRESSION ANALYSIS OF FOUR PREDICTOR VARIABLES WITH EDMONTON PUBLIC SCHOOL READING TEST--YEAR II (N=112)

Step	Predictor Variable	F Value	Mult. R	% Variance Accounted For	% Added	R^2
1	MRTC	60.47 *	.596	35.47	-	.355
2	PRST	39.84 *	.650	42.23	6.76	.422

* $p < .01$.

TABLE 6

MULTIPLE REGRESSION ANALYSIS OF FOUR PREDICTOR VARIABLES WITH EDMONTON PUBLIC SCHOOL MATHEMATICS TEST--YEAR II (N=112)

Step	Predictor Variable	F Value	Mult. R	% Variance Accounted For	% Added	R^2
1	VADS	26.51 *	.441	19.42	-	.194

* $p < .01$.

TABLE 7

SUMMARY OF THE MULTIPLE REGRESSION ANALYSES OF THE ACCURACY OF USING THE ENTIRE TEST BATTERY TO PREDICT GRADE ONE ACHIEVEMENT (IN ORDER OF CONTRIBUTION TO MODEL)

Criteria	Predictor Tests *	Total % of Variance Accounted For
Year I		
MRTC	VADS, PRST, VMI	50.5
Year II		
SATT	MRTC, VADS, PRST	60.4
EPSR	MRTC, PRST	42.2
EPSM	VADS	19.4

* Significant at .01 level.

the question of the accuracy of predicting grade one achievment using the entire test battery. If we accept that the SATT test includes both Reading and Mathematics components, then we could combine the Edmonton Public School tests. Then, the VADS and PRST tests appear in all three criteria measures. The VADS contributed significantly with the Metropolitan Readiness Test. The second predictor test to appear in three criteria measures was the PRST contributing most significantly with the Metropolitan Readiness Test. The MRTC was significant in two criteria measures. It made the most significant contribution to the Stanford Achievement Test. The VMI was eliminated from the predictive index after Year I, being beyond the .05 level of significance.

Therefore, the results of this analyses indicated that (a) the entire test battery does predict the Year I criterion, (b) the MRTC, VADS, PRST do predict the Year II criteria, (c) the MRTC is the most contributory variable over two years (accounting for 53.8% of the variance) with the Stanford Achievement test, (d) the VADS is effective in predicting grade one achievement using the MRTC as the criterion measure (accounting for 36.4% of the variance), (e) the MRTC is effective in predicting future achievement using the Edmonton Public School Reading Test as the

criterion measure (accounting for 35.5% of the variance), and (f) the VADS is the most contributory (accounting for 19.4% of the variance) predictor variable with the Edmonton Public School Mathematics Test as the criterion measure.

Another way of examining the accuracy of predicting future achievement using the entire test battery involves the use of discriminant function analysis, a particular case of multiple regression. Discriminant function analysis looks at the number of cases which would be either correctly or incorrectly identified given a specific set of criteria. The actual pass/fail standing at the end of grade one is the criteria. Table 8 shows the accuracy of using the total test battery of Year I to predict grade one achievement. The overall hit rate of this particular test battery would seem to be quite impressive at 78.6%. Only 24 (21.4%) children out of 112 were incorrectly labeled. However, out of 19 children who fell into the "fail" group, 14 (73.7%) were accurately identified. Of those children who fell into the "pass" group, 19 out of 93 (20.4%) were misclassified. Stated another way, the chances of not having learning difficulties if labeled "fail" are about 6 in 10 (60%); the chances of having difficulties if labeled "pass" are about 1 in 16 (6.3%).

TABLE 8

PREDICTING GRADE ONE ACHIEVEMENT

(DEVELOPMENTAL TEST OF VISUAL MOTOR INTEGRATION,

VISUAL AURAL DIGIT SPAN TEST, PUPIL RATING SCALE)

USING THE ACTUAL PASS/FAIL RESULTS

OF GRADE ONE--YEAR I

		Predicted		
		Pass	Fail	Total
Actual	Pass	N=74 79.6%	N=19 20.4%	93
	Fail	N=5 26.3%	N=14 73.7%	19
		79	33	112

True Positives 74/93 (79.6%)

False Positives 19/93 (20.4%)

Hits 88/112 (78.6%)

True Negatives 14/19 (73.7%)

False Negatives 5/19 (26.3%)

Misses 24/112 (21.4%)

TABLE 9

PREDICTING GRADE ONE ACHIEVEMENT

(DEVELOPMENTAL TEST OF VISUAL MOTOR INTEGRATION,

VISUAL AURAL DIGIT SPAN TEST, PUPIL RATING SCALE,

METROPOLITAN READINESS TEST)

USING THE ACTUAL PASS/FAIL RESULTS

OF GRADE ONE--YEAR II

		Predicted		
		Pass	Fail	Total
Actual	Pass	N=73 78.5%	N=20 21.5%	93
	Fail	N=6 31.6%	N=13 68.4%	19
		79	33	112

True Positives 73/93 (78.5%)

False Positives 20/93 (21.5%)

Hits 86/112 (76.8%)

True Negatives 13/19 (68.4%)

False Negatives 6/19 (31.6%)

Misses 26/112 (23.2%)

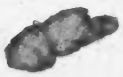

Table 9 shows the accuracy of using the total test battery of Year II to predict grade one achievement. The overall hit rate (76.8%) appears to be less accurate than the Year I test battery. Out of 112 children, only 26 (23.2%) were misclassified. Of the 19 children who fell into the "fail" group, only 13 (68.4% were accurately identified. Out of 93 children who fell into the "pass" group, 20 (21.5%) were misclassified. The chances of not having learning difficulties if labeled "fail" are close to 6 in 10 (57.6%); the chances of having difficulties if labeled "pass" are about 1 in 13 (7.6%).

In summary, the Year I test battery has a better hit rate than does the Year II battery. Also, the Year I battery has the smallest percentage of false positives (20.4%) and false negatives (26.3%). Therefore, the Year I test battery would be preferable for screening. Fewer children would be misclassified.

Predictor Variable Subtest Effectiveness

Question 6. What is the rank order of predictor variable subtests from the most effective to the least effective?

The percentage of accuracy of predicting grade one achievement using the entire test battery of Year I and II leaves too much margin for error, particularly the false

negatives. A rank order of coefficients of correlation was conducted to determine the order of importance of all predictor variable subtests with each criterion. A multiple regression analysis was computed to determine the discriminative ranking of predictor variables that would result in the best prediction of each criterion.

The rank order of coefficients of correlation of all predictor variable subtests (Year I) with the Metropolitan Readiness Test criterion is reported in Table 10. Included are the percentage of variance accounted for and the correlation squared. All subtests were significant at the .001 level. None of the subtests accounted for enough of the variance to be used singly as a predictive instrument. However, a combination of some of the most effective predictor variable subtests may account for sufficient variance to improve the prediction.

A multiple regression analysis was computed to determine which of the more effective predictor variables would result in the best prediction of each criterion. Table 11 shows the multiple regression procedure for the criterion Metropolitan Readiness Test. The first variable to enter the model was the PRSV subtest of the Pupil Rating Scale, accounting for 37.7% of the variance. This was followed

TABLE 10

RANK ORDER OF COEFFICIENTS OF CORRELATION OF ALL PREDICTOR VARIABLE SUBTESTS WITH THE MRT CRITERION

YEAR I

Variable	r	R^2	% Variance Accounted For
PRSV	.615 *	.378	37.82
PRSS	.602 *	.362	36.24
PRSA	.594 *	.353	35.28
AI	.584 *	.341	34.11
INTER	.570 *	.325	32.49
OE	.565 *	.319	31.92
INTRA	.550 *	.303	30.25
VI	.529 *	.280	27.98
WE	.522 *	.272	27.25
AW	.514 *	.264	26.42
PRSN	.507 *	.257	25.70
PRSP	.469 *	.220	22.00
PRSO	.464 *	.215	21.53
VO	.464 *	.215	21.53
VW	.458 *	.210	20.98
AO	.451 *	.203	20.34
PRSM	.385 *	.148	14.82

* Significant at .001 level.

TABLE 11

MULTIPLE REGRESSION ANALYSIS OF SEVENTEEN PREDICTOR VARIABLE SUBTESTS WITH THE METROPOLITAN READINESS TEST CRITERION

YEAR I (N=235)

Step	Predictor Variable	F Value	Mult. R	% Variance Accounted For	% Added	R^2
1	PRSV	141.45 *	.615	37.70	-	.378
2	AI	120.79 *	.714	51.01	13.31	.510
3	OE	84.47 *	.723	52.31	1.30	.523

* $p < .01$.

by the second variable, AI, which raised the percentage of variance to 51.0. The final variable to enter into the model, significant at the .01 level, was the OE subtest of the VADS test, which increased the percentage to 52.3. These three variables were in the top six on the rank order of predictor variable subtests reported in Table 10.

Table 12 shows the rank order of the coefficients of correlation of all predictor variable subtests with the Year II criterion Stanford Achievement Test. All subtests were significant at the .001 level. The highest ranked variable was the MRTL with a correlation of .612. This was followed by MRTQ, correlation of .600, and MRTR, correlation of .560. Both AI and PRSV had correlations of .527. Next in order was PRSS with a correlation of .523. The sixth in order were MRTV and INTER variables with correlations of .517. The best of these predictor variables (MRTL) accounted for only 37.5% of the variance.

A multiple regression analysis procedure for the criterion Stanford Achievement Test is reported in Table 13. The first variable to enter the model was the PRSV, accounting for 41.4% of the variance. This was followed by the second variable, AI, which increased the percentage of variance to 50.8. The next variable to enter the equation

TABLE 12

RANK ORDER OF COEFFICIENTS OF CORRELATION
OF ALL PREDICTOR VARIABLE SUBTESTS
WITH THE SAT CRITERION
YEAR II

Variable	r	R^2	% Variance Accounted For
MRTL	.612 *	.375	37.45
MRTQ	.600 *	.360	36.00
MRTR	.560 *	.314	31.36
AI	.527 *	.278	27.77
PRSV	.527 *	.278	27.77
PRSS	.523 *	.274	27.35
MRTV	.517 *	.267	26.73
INTER	.517 *	.267	26.73
PRSA	.504 *	.254	25.40
INTRA	.500 *	.250	25.00
WE	.495 *	.245	24.50
AW	.485 *	.235	23.52
MRTS	.484 *	.234	23.43
VI	.477 *	.228	22.75
MRTA	.475 *	.226	22.56
OE	.456 *	.208	20.79
VW	.440 *	.194	19.36
MRTLR	.428 *	.183	18.32
MRTVM	.416 *	.173	17.31
PRSP	.413 *	.171	17.06
PRSN	.401 *	.161	16.08
VO	.368 *	.135	13.54
AO	.342 *	.117	11.70
PRSM	.317 *	.100	10.05
PRSO	.305 *	.093	9.30

* Significant at .001 level.

TABLE 13

MULTIPLE REGRESSION ANALYSIS OF TWENTY-FIVE PREDICTOR VARIABLE SUBTESTS WITH THE STANFORD ACHIEVEMENT TEST CRITERION YEAR II (N=112)

Step	Predictor Variable	F Value	Mult. R	% Variance Accounted For	% Added	R^2
1	PRSV	77.67 *	.643	41.39	-	.414
2	AI	56.16 *	.712	50.75	9.36	.508
3	MRTQ	45.90 *	.749	56.04	5.29	.560
4	MRTV	39.72 *	.773	59.75	3.71	.598
5	MRTR	33.70 *	.783	61.38	1.63	.614

* $p < .01$.

was the MRTQ, bringing the percentage of variance accounted for to 56.0. The fourth variable to enter was MRTV, raising the percentage of variance to 60.0. The final variable to enter into the model, significant at the .01 level, was the MRTR, which increased the percentage to 61.4. All five of these variables were in the top seven on the rank order of predictor vaaiable subtests reported in Table 12.

Table 14 shows the rank order of coefficients of correlation of all predictor variable subtests with the Year II criterion Edmonton Public School Reading Test. The top twenty variables were significant at the .001 level. Variable twenty-four was significant at the .01 level, and variable twenty-five was significant at the .05 level. The top ranked predictor variable (PRSV) had a correlation of .568. Next was the PRSS with a correlation of .555. This was followed by PRSA, correlation .554. The fourth ranked variable (PRSN) had a correlation of .523. Another Pupil Rating Scale subtest, PRSP, ranked fifth with a correlation of .519. The next variable, MRTL, was ranked sixth, correlation of .488. This was closely followed by AI with a correlation of .486. The eighth variable was MRTQ, which had a correlation of .463. The best of these eight predictor variable subtests (PRSV) accounted for only 32.3%

TABLE 14

RANK ORDER OF COEFFICIENT OF CORRELATION
OF ALL PREDICTOR VARIABLE SUBTESTS
WITH THE EPSR CRITERION
YEAR II

Variable	r	R^2	% Variance Accounted For
PRSV	.568 ***	.323	32.26
PRSS	.555 ***	.308	30.80
PRSA	.554 ***	.296	29.59
PRSN	.523 ***	.274	27.35
PRSP	.519 ***	.269	26.94
MRTL	.488 ***	.238	23.81
AI	.486 ***	.236	23.62
MRTQ	.463 ***	.214	21.44
MRTA	.457 ***	.209	20.88
INTRA	.452 ***	.204	20.43
MRTR	.451 ***	.203	20.34
PRSO	.442 ***	.195	19.54
WE	.421 ***	.177	17.72
AW	.414 ***	.171	17.14
MRTS	.394 ***	.155	15.52
PRSM	.390 ***	.152	15.21
MRTLR	.383 ***	.147	14.67
VW	.371 ***	.138	13.76
AO	.369 ***	.136	13.62
INTER	.365 ***	.133	13.32
MRTV	.363 ***	.132	13.18
VI	.330 ***	.109	10.89
OE	.312 ***	.097	9.73
MRTVM	.223 **	.050	4.97
VO	.172 *	.030	2.96

* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 15

MULTIPLE REGRESSION ANALYSIS OF TWENTY-FIVE PREDICTOR VARIABLE SUBTESTS WITH THE EDMONTON PUBLIC SCHOOL READING TEST CRITERION YEAR II (N=112)

Step	Predictor Variable	F Value	Mult. R	% Variance Accounted For	% Added	R^2
1	PRSV	56.18 *	.581	33.81	-	.338
2	AI	36.63 *	.634	40.20	6.39	.402
3	MRTQ	27.38 *	.657	43.20	2.00	.432

* $p < .01$.

TABLE 16

MULTIPLE REGRESSION ANALYSIS OF TWENTY-FIVE PREDICTOR VARIABLE SUBTESTS WITH THE EDMONTON PUBLIC SCHOOL MATHEMATICS TEST CRITERION YEAR II (N=112)

Step	Predictor Variable	F Value	Mult. R	% Variance Accounted For	% Added	R^2
1	INTRA	30.48 *	.466	21.70	-	.217
2	MRTQ	19.74 *	.516	26.59	4.89	.266
3	MRTV	17.05 *	.567	32.14	5.55	.321

* $p < .01$.

TABLE 17

RANK ORDER OF COEFFICIENTS OF CORRELATION OF ALL PREDICTOR VARIABLE SUBTEST WITH THE EPSM CRITERION

YEAR II

Variable	r	R^2	% Variance Accounted For
INTRA	.420 ***	.176	17.64
AI	.412 ***	.170	16.97
WE	.406 ***	.165	16.48
INTER	.406 ***	.165	16.48
VI	.398 ***	.158	15.84
AW	.379 ***	.144	14.36
VW	.378 ***	.143	14.29
MRTQ	.365 ***	.133	13.32
OE	.360 ***	.130	12.96
MRTR	.352 ***	.124	12.39
MRTL	.338 ***	.114	11.42
PRSP	.291 ***	.085	8.47
MRTA	.291 ***	.085	8.47
VO	.287 ***	.082	8.24
AO	.284 ***	.081	8.07
PRSN	.268 ***	.072	7.18
MRTV	.238 **	.057	5.66
PRSV	.235 **	.055	5.52
PRSA	.235 **	.055	5.52
MRTS	.225 **	.051	5.06
PRSS	.223 **	.050	4.97
MRTVM	.208 **	.043	4.33
PRSM	.198 **	.039	3.92
MRTLR	.185 *	.034	3.42
PRSO	.180 *	.032	3.24

* $p < .05$
** $p < .01$
*** $p < .001$

of the variance.

A multiple regression analysis procedure for the Edmonton Public School Reading Test is reported in Table 15. The first variable to enter the model was the PRSV, accounting for 33.8% of the variance. This was followed by AI, which raised the percentage of variance to 40.2. The final predictor variable subtest to enter the model, significant at the .01 level, was the MRTQ, bringing the percentage of variance accounted for to 43.2. All three of these variables were in the top eight ranked variables.

Table 17 shows the rank order of coefficients of correlation of all predictor variable subtests with the Year II criterion Edmonton Public School Mathematics Test. The top sixteen predictor variables were significant at the .001 level. Variables seventeen to twenty-three were significant at the .01 level. The last two variables were significant at the .05 level. The first variable in the rank order was INTRA with a correlation of .420. Variable AI was second with a correlation of .412. Next in order were WE and INTER with a correlation of .406. The fifth variable was VI, correlation .398. This was followed by AW, correlation .379. VW followed closely with a correlation of .378. The eighth ranked variable was the MRTQ, correlation .365.

The best of these eight predictor variables was INTRA, which accounted for only 17.6% of the variance. Over 80% of the variance remained unexplained.

A multiple regression analysis procedure for the Edmonton Public School Mathematics Test is reported in Table 16. The first variable to enter the model was INTRA, accounting for 21.7% of the variance. This was followed by MRTQ, raising the percentage of variance to 26.6. The final variable to enter the model, significant at the .01 level, was the MRTV, which increased the variance to 32.1. Close to 70% of the variance was unexplained. The three predictor variables were scattered in ranking, being in the first, eighth, and seventeenth positions.

In summary, Table 18 summarizes the data pertaining to the question of the rank order of predictor variables subtest effectiveness. The PRSV was ranked first on two criterion measures, Metropolitan Readiness Test and Edmonton Public School Reading Test. It also accounted for the most variance with the criteria Metropolitan Readiness Test, Stanford Achievement Test, and Edmonton Public School Reading Test. The AI predictor variable was ranked fourth with the Metropolitan Readiness Test, fourth with the Stanford Achievement Test, seventh with the Edmonton Public School

TABLE 18

SUMMARY OF THE RANK ORDER OF COEFFICIENTS OF CORRELATION AND MULTIPLE REGRESSION ANALYSES OF PREDICTOR VARIABLE SUBTESTS WITH THE CRITERIA

Criteria	Predictor Variable *	Rank Order	Mult. R	% Variance Accounted For	R^2
MRTC	PRSV	1	.615	37.70	.378
	AI	4	.714	51.01	.510
	OE	6	.723	52.31	.523
SATT	PRSV	5	.643	41.39	.414
	AI	4	.712	50.75	.508
	MRTQ	2	.749	56.04	.560
	MRTV	7	.773	59.75	.598
	MRTR	3	.783	61.38	.614
EPSR	PRSV	1	.581	33.81	.338
	AI	7	.634	40.20	.402
	MRTQ	8	.657	43.20	.432
EPSM	INTRA	1	.466	21.70	.217
	MRTQ	8	.516	26.59	.266
	MRTV	17	.567	32.14	.321

* Significant at .01 level.

Reading Test, and second with the Edmonton Public School Mathematics Test. It accounted for the second most variance with the Metropolitan Readiness Test, Stanford Achievement Test, and Edmonton Public School Reading Test. The MRTQ was not a predictor variable in Year I. It ranked second with the Stanford Achievement Test and eighth with both the Edmonton Public School Reading and Mathematics Tests. The MRTQ accounted for the second most variance with the Edmonton Public School Mathematics Test, and third with the Stanford Achievement Test and the Edmonton Public School Reading Test.

Therefore, the results of these analyses indicated that (a) there was a discrepancy between the rank order of variables as effective predictors of grade one achievement and the multiple regression findings, (b) the PRSV was the most contributory variable across both years (accounting for 33.8 to 41.4% of the variance), (c) the AI was the second most contributory predictor variable subtest (adding between 6.4 to 13.3% to the variance), (d) the MRTQ was the third most contributory (adding between 2.0 to 5.6% to the variance), (e) the predictor variable subtests PRSV, AI, MRTQ, MRTV, and MRTR were the best combination of variables (accounting for a total of 61.4% of the variance) with the

Stanford Achievement Test in Year II, and (f) the predictor variable subtests PRSV, AI, OE were the second best combination of variables and the most concise (accounting for a total of 52.3% of the variance) with the Metropolitan Readiness Test.

Another way of looking at predictor subtest effectiveness was with discriminant function analyses which compared prediction of grade one achievement with actual grade one achievement. Table 19 displays the rank order of predictor variables based upon their overall hit rate. Included are the misses, false negatives, and false positives of each variable. This additional information revealed their potential for misclassification. Selecting four predictor variables based upon the lowest percentage of false negatives would result in a battery comprised of the PRSA (5.3% error), PRSP (10.5% error), AI (21.1% error), and MRTQ (21.1% error). The actual number of children who would actually "fail" when predicted to "pass" was minimized. Conversely, selecting four predictor variables based upon the lowest percentage of false positives would result in a battery composed of AO (9.7% error), PRSM (10.8% error), PRSO (12.9% error), and PRSN (16.1% error). The actual number of children who would actually "pass" when predicted

TABLE 19

DISCRIMINANT FUNCTION ANALYSIS OF ACTUAL GRADE ONE ACHIEVEMENT: RANK ORDER OF PREDICTOR VARIABLE SUBTESTS BY EFFECTIVENESS

Predictor Variable	% Hits	N	% Misses	N	False Negatives	N	False Positives	N
AO	83.9	94	16.1	18	47.4	9	9.7	9
PRSO	83.0	93	17.0	19	36.8	7	12.9	12
PRSM	82.1	92	17.9	20	56.2	10	10.8	10
PRSN	82.1	91	18.8	21	31.6	6	16.1	15
PRSV	77.1	87	22.3	25	36.8	7	19.4	18
AI	77.1	87	22.3	25	21.1	4	22.6	21
PRSS	76.8	86	23.2	26	42.1	8	19.4	18
AW	76.8	86	23.2	26	42.1	8	19.4	18
MRTA	75.9	85	24.1	27	36.8	7	21.5	20
MRTQ	74.1	83	25.9	29	36.8	4	26.9	25
MRTS	74.1	83	25.9	29	36.8	7	23.7	22
MRTR	74.1	83	25.9	29	57.9	11	19.4	18
MRTV	73.2	82	26.8	30	57.9	11	20.4	19
MRTVM	72.3	81	27.7	31	57.9	11	21.5	20
MRTLR	71.4	80	28.6	32	47.4	9	24.7	23
PRSP	70.5	79	29.5	33	10.5	2	33.3	31
MRTL	70.5	79	29.5	33	36.8	7	28.0	26
WE	69.6	78	30.4	34	31.6	6	30.1	28
VW	67.0	75	33.0	37	47.4	9	30.1	28
OE	66.1	74	33.9	38	31.6	6	34.4	32
INTER	66.1	74	33.9	38	31.6	6	34.4	32
INTRA	64.3	72	35.7	40	42.1	8	34.4	32
VO	62.5	70	37.5	42	52.6	10	34.4	32
VI	59.8	67	40.2	45	26.3	5	43.0	40
PRSA	58.0	65	42.0	47	5.3	1	49.5	46

to "fail" would be minimized. The latter battery of subtests would seem to be the superior choice considering that: (a) the same predictor variable subtests also had the highest overall hit rates, (b) fewer children with learning problems would escape detection, and (c) false positives errors may be less damaging to a child's image of his academic ability. However, none of the predictor variables identified as the most effective by virtue of having the smallest percentage of false negatives or false positive errors was identified by the rank order of coefficients of correlation and multiple regression procedures. Selection of predictor variable subtests based upon the highest possible hit rates and smallest possible false negative and false positive errors resulted in the identification of the AI, MRTQ, MRTA, PRSN, and PRSV variables. Three of these subtest variables (AI, MRTQ, and PRSV) were also identified using the rank order of correlations and the multiple regression procedures.

Skills Versus Processes--Power to Predict

Question 7. Which has the greater power to influence predictions--processes or skills?

The Metropolitan Readiness Test and the Visual Aural Digit Span Test were selected from the test battery as

measures of skills and processes respectively. Process and skills subtests were analyzed separately from the total tests to eliminate any redundancy. Table 20 presents the rank order of all predictor variable subtests based upon their hit rates. The variables were separately listed as skills or process predictor variables to indicate their rank order and clustering. The AO (Aural-Oral) variable was first in rank order with a hit rate of 83.9%. The second variable in rank order was the AI (Aural-Input) with a hit rate of 77.7%. This was followed by the AW (Aural-Written) with a hit rate of 76.8%. All of these variables measured processes. Also, they all share an auditory component. It would appear that auditory abilities are of primary importance in accurately predicting grade one achievement. The fourth variable in rank order was the skills subtest MRTA with a hit rate of 75.9%. This skills variable also measures auditory abilities. Following the MRTA subtest were all the remaining subtests of the MRT (Metropolitan Readiness Test). The clustering of all subtests of the MRT test suggested that skills variables can predict future academic achievement both accurately and consistently. All the remaining subtests of the VADS (Visual Aural Digit Span Test) clustered together at the

TABLE 20

RANK ORDER OF SKILLS VERSUS PROCESSES IN

PREDICTING GRADE ONE ACHIEVEMENT

Skills Variable	Process Variable	% of Hits	% of Misses	False Negatives	False Positives
-	AO	83.9	16.1	47.4	9.7
-	AI	77.7	22.3	21.1	22.6
-	AW	76.8	23.2	42.1	19.4
MRTA	-	75.9	24.1	36.8	21.5
MRTQ	-	74.1	25.9	36.8	26.9
MRTS	-	74.1	25.9	36.8	23.7
MRTR	-	74.1	25.9	57.9	19.4
MRTV	-	73.2	26.8	57.9	20.4
MRTVM	-	72.3	27.7	57.9	21.5
MRTLR	-	71.4	28.6	47.4	24.7
MRTL	-	70.5	29.5	36.8	28.0
-	WE	69.6	30.4	31.6	30.1
-	VW	67.0	33.0	47.4	30.1
-	OE	66.1	33.9	31.6	34.4
-	INTER	66.1	33.9	31.6	34.4
-	INTRA	64.3	35.7	42.1	34.4
-	VO	62.5	37.5	52.6	34.4
-	VI	59.8	40.2	26.3	43.0

bottom of the rank order of coefficients of correlation. All of these subtest variables were significant at the .05 level.

The results indicated that: (a) the largest number of children would be accurately classified using the process variables with an auditory component, (b) process and skills variables, with an auditory component have the greatest power to influence predictions, (c) the MRT skills variables were second in power to influence predictions, and (d) the VADS process variables excluding those with an auditory component, have the least power to influence predictions.

Tables 21 and 22 present the overall accuracy of using the MRT (Metropolitan Readiness Test of skills) versus the VADS (Visual Aural Digit Span Test of processes) to determine which was the more powerful predictor. Overall, the MRT test had a hit rate of 76.8%. The VADS test accurately classified only 71.4% of the children. However, the MRT showed a 31.6% rate of false negatives, while the VADS was only 26.3%. The opposite was true of false positive errors. The MRT allowed fewer errors (18.3%) compared to the VADS which was 29.0%. Based upon the data, using the entire MRT skills test would seem to slightly increase the percentage of children who would be accurately

TABLE 21

SKILLS TEST IN PREDICTING

GRADE ONE ACHIEVEMENT

USING YEAR END DATA

		MRTC Predictor		
		Pass	Fail	Total
Actual	Pass	N=74 79.6%	N=19 18.3%	93
	Fail	N=7 31.6%	N=12 64.4%	19
		81	31	112

Hits = 86/112 (76.8%)

Misses = 26/112 (23.2%)

TABLE 22

PROCESSES IN PREDICTING

GRADE ONE ACHIEVEMENT

USING YEAR END DATA

		VADS Predictor		
		Pass	Fail	Total
Actual	Pass	N=66 71.0%	N=27 29.0%	93
	Fail	N=5 26.3%	N=14 73.7%	19
		71	41	112

Hits = 80/112 (71.4%)

Misses = 32/112 (28.6%)

classified.

In summary, Table 23 summarizes the data pertaining to the question of which has more power to influence predictions--processes or skills.

From this table it becomes evident that process variables with an auditory component have the greatest power to influence predictions based upon their hit rates. The total MRT test of skills has as much power to influence predictions as does the AW (Aural Written) process variable. This finding was supported by the solid clustering of all MRT subtests of skills. The total VADS test of processes had a hit rate of 71.4% giving it as much power to influence predictions as the MRTLR skills variable. The fact that some process variables, particularly the VI and VO, had poor hit rates seems to have reduced the overall power of the VADS test to influence predictions.

Kindergarten Teachers' Readiness Constructs

Question 8. What is the rank order of kindergarten teachers' readiness constructs from the most important to the least important?

Frequencies were calculated for all kindergarten teachers' readiness constructs (KTRC). The constructs were ranked by frequencies. Results are reported in Table 24.

TABLE 23

SUMMARY OF RANK ORDER ANALYSES OF THE POWER OF SKILLS VERSUS PROCESSES TO INFLUENCE PREDICTION

Test Variable	Skills Variable	Process Variable	% Hits	% Misses
-	-	AO	83.9	16.1
-	-	AI	77.7	22.3
MRTC	-	AW	76.8	23.2
-	MRTA	-	75.9	24.1
-	MRTQ	-	74.1	25.9
-	MRTS	-	74.1	25.9
-	MRTR	-	74.1	25.9
-	MRTV	-	73.2	26.8
-	MRTVM	-	72.3	27.7
VADS	MRTLR	-	71.4	28.6
-	MRTL	-	70.5	29.5
-	-	WE	69.6	30.4
-	-	VW	67.0	33.0
-	-	OE	66.1	33.9
-	-	INTER	66.1	33.9
-	-	INTRA	64.3	35.7
-	-	VO	62.5	37.5
-	-	VI	59.8	40.2

TABLE 24

FREQUENCIES OF KINDERGARTEN TEACHERS' READINESS CONSTRUCTS (N=11)

	KTRC	Frequencies
1.	Has good listening skills	10
2.	Has a positive self-concept	10
3.	Can communicate feelings & ideas verbally and share with others	7
4.	Is developing fine motor skills	6
5.	Recognizes & prints numbers 1--10	6
6.	Has a broad background of knowledge and experiences	6
7.	Has developed an attention span	6
8.	Auditory discrimination--letters, rhyming words, other sounds	6
9.	Understands number concepts (one-to-one)	6
10.	Can work independently & complete tasks	5
11.	Visual discrimination--shapes, colors, letters, numbers, size, etc.	5
12.	Follows complex directions	5
13.	Gets along well with others	5
14.	Has a positive attitude toward school and learning	5
15.	Works cooperatively in large and small groups	4

Table 24 Continued

	KTRC	Frequencies
16.	Is developing gross motor skills	4
17.	Has self-confidence	4
18.	Prints name	4
19.	Recognizes alphabet letters (upper/lower case)	4
20.	Age (five years by Dec. 31)	4
21.	Recognizes name, address, phone number	4
22.	Is willing to try new things	4
23.	Can work independently	4
24.	Shows curiosity & interest in learning	4
25.	Counts numbers 1--20	3
26.	Reasoning, problem-solving in social situation	3
27.	Is developing (L.T.M.) and (S.T.M.) memory	3
28.	Active participant in learning	2
29.	Adapts well to new situations	2
30.	Developing classification skills--classes, colors, shapes, etc.	2
31.	Physical skills-dressing, toileting, eating	2
32.	Ordering--sequencing, organizing	2
33.	Time sequencing--today, tomorrow, yesterday	2
34.	Vocabulary--word knowledge	2
35.	Responsibility for own learning	2
36.	Accepts & follows rules & routines	2

Table 24 Continued

	KTRC	Frequencies
37.	Responsible for own actions	2
38.	Gives effort on tasks	2
39.	Can manipulate games, puzzles, etc.	2
40.	Home environment--supportive	2
41.	Strings ideas into logical sequences to speak	2
42.	Speaks in complete (meaningful) sentences	2
43.	Measurement	1
44.	I.Q.	1
45.	Developing left-right discrimination	1
46.	Has imagination	1
47.	Learns from errors(self-corrects)	1
48.	Expresses emotions appropriately	1
49.	Has a sense of humour	1
50.	Has a sense of family unit	1
51.	Has a knowledge of body parts & configuration	1
52.	Developing personal hygiene	1
53.	Developing eye-hand coordination	1

The small sample size of eleven kindergarten teachers prevents the calculation of percentages of frequencies. Percentages would be distorted, thus misleading.

From the readiness construct data, the first and most important constructs to emerge were listening abilities and a positive self concept with a frequency of 10. Next in order was the ability to communicate feelings and ideas verbally and share with others. This construct had a frequency of 7. Following with a frequency of 6 were developing fine motor skills, recognizes and prints numbers 1 to 10, has a broad background of knowledge and experiences, has developed an attention span, auditory discrimination, and understands number concepts. Although many constructs followed these, less than 50% of the kindergarten teachers were in concurrence as to their importance.

Another way of looking at the data is to categorize constructs using the categories suggested by the kindergarten teachers. The first category used was "social". It was used in the following manner: social maturity, social skills, social development, and social. A similar pattern was used with the terms "physical", "intellectual", and "emotional". The term "background" also was used to categorize constructs. Table 25 shows the categorized

TABLE 25

FREQUENCY OF KINDERGARTEN TEACHERS' READINESS CONSTRUCTS BY BEHAVIOR CATEGORY

Rank	Constructs	Frequency
	Background:	
6.	A broad background of knowledge & experiences	6
20.	Age--5 years by December 31	4
21.	Recognizes name, address, phone number	4
39.	Can manipulate games, puzzles, etc.	2
40.	Home environment	2
44.	I.Q.	1
	Social Behavior:	
1.	Has good listening skills	10
3.	Can communicate feelings & ideas verbally & share with others	7
10.	Can work independently & complete tasks	5
13.	Gets along well with others	5
15.	Can work cooperatively in large & small groups	4
22.	Is willing to (risk) try new things	4
26.	Reasoning, problem-solving in social situations	3
29.	Adapts to new situations	2
50.	Has a sense of family unit	1
	Physical Behavior:	
4.	Is developing fine motor skills	6

Table 25 Continued

Rank	Constructs	Frequency
	Physical Behavior:	
16.	Is developing gross motor skills	4
18.	Can print name	4
21.	Physical skills--dressing, toileting, eating	2
39.	Can manipulate games, puzzles, etc.	2
52.	Is developing personal hygiene	1
53.	Developing eye-hand coordination	1
45.	Developing left-right discrimination	1
	Intellectual Behavior:	
5.	Recognizes and prints numbers 1--10	6
7.	Has developed an attention span	6
8.	Auditory discrimination--letters, rhyming words	6
9.	Understands number concepts	6
11.	Visual discrimination--shapes, colors, classes	5
12.	Follows complex directions	5
19.	Recognizes the alphabet (upper/lower case)	4
24.	Curiosity & interest in learning	4
25.	Counts numbers 1--20	3
27.	Has developed long & short term memory recall	3
30.	Is developing classification skills--colors, shapes, classes	2
32.	Ordering--sequencing, organizing	2

Table 25 Continued

Rank	Constructs	Frequency
	Intellectual Behavior:	
33.	Time sequence--today, yesterday, tomorrow	2
34.	Vocabulary--word knowledge	2
41.	Strings ideas into logical sequences to speak	2
42.	Speaks in sentences	2
43.	Measurement	1
46.	Has imagination	1
51.	Has knowledge of body parts & configurations	1
	Emotional Behavior:	
2.	Has a positive self-concept	10
14.	Has a positive attitude toward school & learning	5
17.	Has self-confidence	4
23.	Can work independently	4
28.	Is an active participant in learning	2
35.	Responsibility for own learning	2
37.	Is responsible for own actions	2
38.	Gives effort on tasks	2
36.	Accepts & follows rules & routines	2
48.	Expresses emotions appropriately	1
49.	Has a sense of humour	1
47.	Learns from errors (self-corrects)	1

constructs using the categories (a) background, (b) social behavior, (c) physical behavior, (d) intellectual behavior, and (e) emotional behavior. Frequency statistics were computed. Categories were ranked by the percentage of constructs having frequencies within the range of 5 to 10. Social behavior ranked first with 4 constructs out of 9 (44.4%) having frequencies within the specified range. Intellectual behavior ranked second with 6 constructs out of 19 (or 31.6%) having frequencies within the specified range of 5 to 10. The third in rank order was emotional behavior with 2 out of 12 constructs (or 16.7%) and background with 1 out of 6 (or 16.7%) having frequencies within the specified range. One of the emotional constructs had the highest frequency of 10, suggesting that emotional behavior may be more important than is background. Physical behavior was lowest in rank order with 1 construct out of 8 (or 12.5%) having a frequency within the specified range.

In summary, cumulative frequencies and percentages were not used to rank order kindergarten teachers' readiness constructs (KTRC). Cumulative frequencies would be misleading given the discrepancy in number of constructs assigned to each category. The small sample size made the percentages appear larger than they might be given a larger

sample. Ranking of the categories of constructs was based upon the percentage of constructs having frequencies within the range of 5 to 10. The rank order of the kindergarten teachers' readiness construct categories from the most important to the least important were: (a) social behavior (44.4%), (b) intellectual behavior (31.6%), (c) emotional behavior and background (16.7%), and (d) physical behavior (12.5%).

Relationship Between Kindergarten Teachers' Readiness Constructs (KTRC) and the Pupil Rating Scale Constructs (PRSC)

Question 9. Do kindergarten teachers' readiness constructs equate with those of the PRS?

The relationship between the KTR constructs and the PRS constructs is reported in Table 26. The KTR constructs were equated with the PRS constructs when the meanings were clearly similar. A total of 53 constructs were submitted by the kindergarten teachers. Constructs were selected from the KTR construct pool and were equated with the 24 PRS constructs where appropriate. Some KTR constructs were equated with more than one PRS construct. The repetition occurred where KTR constructs were very general as is vocabulary, or where the PRS constructs were very

TABLE 26

EQUATING OF KTR CONSTRUCTS WITH PRS CONSTRUCTS

	PRS Constructs	KTR Constructs	f
* 1	Comprehending Word Meaning	-Vocabulary	2
* 2	Following Instructions	- Following Complex Directions	5
3	Comprehending Class Discussion	-Has good listening skills	10
		-Can communicate feelings & ideas verbally and share with others	7
* 4	Retaining Information	-Is developing long & short term memory	3
* 5	Vocabulary	-Vocabulary	2
* 6	Grammar	-Speaks in complete sentences	2
* 7	Word Recall	-Vocabulary	2
* 8	Storytelling	-Strings ideas into logical sequences when speaking	2
* 9	Expression of Ideas	-Can communicate feelings & ideas verbally and share with others	7

Table 26 Continued

	PRS Constructs	KTR Constructs	f
10	Judging Time	-Time sequence--today, yesterday, tomorrow	2
* 11	Spatial Relations	-(none)	0
* 12	Judging Relationships	-Is developing classification skills	2
13	Knowing Directions	-Has left-right discrimination	2
* 14	General Coordination	-Developing gross motor skills	4
* 15	Balance	-Developing gross motor skills	4
* 16	Manual Dexterity	-Developing fine motor skills	6
* 17	Cooperation	-Works cooperatively in large & small groups	4
* 18	Attention	-Developing an attention span	6
19	Organization	-(none)	0
* 20	New Situations	-Adapts to new situations	2
* 21	Social Acceptance	-Gets along well with others	5
22	Responsibility	-Is responsible for own learning	2

Table 26 Continued

	PRS Constructs	KTR Constructs	f
		-Is responsible for own actions	2
* 23	Completion of Assignments	-Can work independently & complete tasks	5
24	Tactfulness	-Expresses emotions appropriately	1

* Denotes comparable matches of constructs.

specific as were general coordination and balance. These two PRS constructs were considered specific cases of the more general KTR gross motor skills construct. As a result, only 13 KTR constructs were equated with 18 PRS constructs.

There were 18 out of 24 PRS constructs where a comparable KTR construct was found. This represented a 75% match in constructs. No comparable KTR constructs were found to equate exclusively with 6 out of 24 (25%) of the PRS constructs. None of the KTR constructs were found to even partially equate with the PRS organization construct. Further, only 6 of the KTR constructs equated with the PRS constructs had frequencies within the specified range of 5 to 10. Looking at the data from this perspective reduced the match rate to 33% from the overall rate of 75%.

It must be emphasized that, with a small sample of 11 kindergarten teachers, these results were not conclusive evidence that a relationship existed between the KTRC and PRSC. Rather, the KTR constructs represented only a range of possible kindergarten teachers' responses to the successful prediction of future achievement. Equating the KTR constructs with the PRS constructs simply suggested that a possible relationship may exist between the two sets of constructs.

In summary, because of small sample size, no generalizations could be made on whether KTR constructs equated with those of the PRS. From the analysis, it would seem that a degree of relationship may exist. The exact degree of the relationship could not be determined with the present data.

Question 10. What are the practical implications of this assessment procedure for psychologists and teachers?

The question of the implications of these findings as related to the literature is best considered in the discussion chapter.

Summary

In this study, the use of a single test to predict grade one achievement was analyzed. The Visual Aural Digit Span Test (VADS) only accounted for 36.4% of the variance. Following was the Pupil Rating Scale (PRST) accounting for 33.5% of the variance. The Developmental Test of Visual Motor Integration (VMI) accounted for a mere 20.7% of the variance. More than 60% of the variance remained unexplained with the best of these Year I tests.

The Metropolitan Readiness Test became a predictor variable in Year II of this study. It accounted for a range of variance from a high of 56.8% to a low of 16.5%

with the following criteria: Stanford Achievement--Auditory Score (SATA), SAT--Reading Score (SATR), SAT--Mathematics Score (SATM), SAT--Total Score (SATT), Edmonton Public School Reading Test (EPSR), and EPS--Mathematics Test (EPSM). The percentage of unexplained variance ranged from 43.2 to 83.5. Although more of the variance was accounted for by using the MRTC to predict Year II criteria, a combination of tests may improve the predictive accuracy even more.

The analysis of the accuracy of using the entire test battery to predict grade one achievement revealed that (a) the entire Year I battery (PRST, VADS, VMI) does predict the Year I criterion (MRTC) accounting for a total of 50.5% of the variance, (b) the MRTC, VADS, PRST tests of the Year II battery did predict the Year II criteria (accounting for as much as 60.4% of the variance), (c) the MRTC was the most contributory predictor variable (accounting for 53.8% of the variance) with the Stanford Achievement Test, (d) the VADS was effective in predicting grade one achievement using the MRTC as the criterion (accounting for 36.4% of the variance, (e) the MRTC was effective in predicting future achievement using the EPSR as the criterion (accounting for 35.5% of the variance), and (f) the VADS was the most contributory predictor variable (accounting for 19.4%

of the variance) with the EPSM as the criterion. All the predictor variables (tests) were significant at the .01 level. Discriminant function analysis indicated that the Year I test battery had a better hit-rate (78.6%) than did the Year II battery (76.8%). Also, the Year I battery had the fewest false positives (20.4%) and false negatives (26.3%). The Year I test battery would be preferable to the Year II battery for screening purposes. Fewer children would be misclassified.

Correlation coefficients of the predictor variable subtests were rank ordered to determine which were the most effective. Secondly, a multiple regression analysis was computed to identify those variables that would combine to result in the best prediction of each criterion. The results of these analyses revealed that (a) the top ranked predictor variable did not consistently combine with other variables for the best possible prediction, (b) the PRSV was the most contributory variable across both years (accounting for 33.8% to 41.4% of the variance), (c) the AI was the second most contributory predictor variable (adding between 6.4% to 13.3% to the variance), (d) the MRTQ was the third most contributory (adding between 2.0% to 5.6% to the variance), (e) the predictor variable subtests PRSV, AI, MRTQ,

MTRV, and MRTR were the best combination of variables (accounting for a total of 61.4% of the variance) with the Stanford Achievement Test in Year II, and (f) the predictor variable subtests PRSV, AI, and OE were the second best combination of variables and the most concise (accounting for a total of 52.3% of the variance) with the Metropolitan Readiness Test in Year I. Finally, discriminant function analysis identified the AI, MRTQ, MRTA, PRSN, and PRSV as having the highest hit-rates and smallest possible false negatives and false positives. Three of these subtest variables (AI, MRTQ, and PRSV) also were identified as effective predictors using rank order of correlation coefficients and multiple regression procedures.

The use of the Metropolitan Readiness Test and the Visual Aural Digit Span Test as measures of the power of skills versus processes to influence predictions revealed that (a) the largest number of children would be accurately classified using the process variables (AO, AI, AW) with an auditory component, (b) process and skills variables with an auditory component (AO, AI, AW, and MRTA) had the greatest power to influence predictions (83.9% to 95.9% hit-rates), (c) MRT skills variables were second in power to influence predictions (75% to 70.5% hit-rates), and

(d) the VADS process variables, excluding those with an auditory component, had the least power to influence predictions (69.6% to 59.8% hit-rates). The total MRT test of skills had as much power to influence predictions as did the AW process variable (76.8% hit-rate), whereas the total VADS test of processes had a hit-rate of 71.4%.

Frequencies calculated for the kindergarten teachers' readiness constructs revealed that (a) the most important constructs were listening abilities and a positive self-concept (f=10), (b) the second in rank order of frequency was the ability to communicate feelings and ideas verbally and share with others (f=7), and (c) third in rank order were: developing fine motor skills, recognizes and prints numbers 1 to 10, has a broad background of knowledge and experiences, has developed an attention span, auditory discrimination, and understands number concepts (f=6). The rank order of kindergarten teachers' readiness constructs categories were (a) social behavior (44.4%), (b) intellectual behavior (31.6%), (c) emotional behavior and background (16.7%), and (d) physical behavior (12.5%).

No generalizations were made about the relationship between the kindergarten teachers' readiness constructs and the Pupil Rating Scale constructs. A sample of 11 kinder-

garten teachers prevented such conclusions being made. From the analysis, it would seem that some relationship may exist. The exact degree of the relationship cannot be determined with the present data.

CHAPTER V

DISCUSSION

Introduction

The expressed desire of educators to provide preventive rather than remediative education has resulted in a search for screening instruments which would identify kindergarten children who would experience learning problems in grade one, particularly the milder psychoeducational problems more difficult to identify. Limiting the sample in this study, by exclusion of children with more obvious mental and physical disabilities, was an attempt to focus the identification procedure on those children with milder psychoeducational problems. The results of this study provide an effective psychoeducational battery to assess: (1) the academic readiness of kindergarten children entering grade one--Year I, and (2) grade one students--Year II. Three instruments (Year I): Visual Aural Digit Span Test (VADS), Developmental Test of Visual Motor Integration (VMI), and the Pupil Rating Scale (PRST) can provide the educator with an effective battery for academic screening, however, a combination of subtests: Pupil Rating Scale--Verbal Score (PRSV), Aural Input (AI) subtest of the VADS, and Oral Expression (OE) subtest of the VADS provides a more

effective and efficient screening battery. Three instruments (Year II): Metropolitan Readiness Test--Composite Score (MRTC), Visual Aural Digit Span Test (VADS), and the Pupil Rating Scale (PRST) provide educators with an effective screening battery for use with grade one students. Again, a combination of subtests proves to be more effective and efficient than are total tests. The combination of subtests varied according to the criterion employed. The best combination of subtests with the criterion Stanford Achievement Test were: Pupil Rating Scale--Verbal Score (PRSV), Aural Input (AI), Metropolitan Readiness Test--Quantitative Score (MRTQ), Metropolitan Readiness Test--Verbal Score (MRTV), and Metropolitan Readiness Test--Rhyming Score (MRTR). With the Edmonton Public School Reading Test, the best combination of subtest variables were: The PRSV, AI, and MRTQ as above. The best combination of subtest variables with the Edmonton Public School Mathematics Test were: Intrasensory Integration (Intra) subtest of the VADS, MRTQ, and MRTV. The use of a combination of subtests rather than the total tests improved the prediction, as well as reducing the testing time. All of the instruments were readily administered by the classroom teacher with the aid of the manuals and minimum practice or

training.

Relationship Between the Findings and Previous Research

The predictive accuracy of employing the PRST, VADS, VMI, MRTC singly to predict future achievement was not recommended. Over 60% of the variance remained unexplained. These instruments, used singly, did not measure all areas of performance. Wallace and Larsen (1978) stated that many researchers have cautioned against the use of a single instrument on the basis that the practice was very restrictive when predictions were being made about future academic performance (Abrahamson & Bell, 1979; Colarusso, Plankenhorn & Brooks, 1980; Hopkins & Sitkei, 1969).

The results of multiple-variable techniques used in this study indicated that the Year I test battery (PRSV, VMI, VADS) did predict the Year I criterion (MRTC), accounting for a total of 50.5% of the variance. These predictor tests yielded correlations of .579, .455, .603 respectively.

When the MRTC was added as a predictor test in Year II, the VMI was excluded as having insufficient predictive power. All of the remaining Year II tests (PRST, VADS, MRTC) did predict the Year II criterion (SAT), accounting for a total of 60.4% of the variance. Of these instruments, the MRTC was the most contributory variable accounting for

53.8% of the variance. The Year II test battery was less effective in predicting the EPSR and EPSM criteria, accounting for 42.2% and 19.4% of the variance, respectively. Lessler and Bridges (1973) used the MRTC with the criterion California Achievement Test. They reported correlations of .73 and concluded that the MRTC was a valid screening device for both placement and compensatory educational decisions. Telegdy (1975) reported correlations of .53 to .73 and considered the MRTC a good predictor of the Wide Range Achievement Test and Gray Oral Reading Test. The present findings were similar to those reported by Telegdy and Lessler and Bridges (.726, $p < .001$).

The analysis of all subtest variables separately from the total tests was intended to (1) reduce redundancy and (2) improve upon prediction of each criterion. The results indicated that ranking correlations of all subtests was less effective than the multiple regression procedure for determining the discriminative ranking of the predictor variables. In the present study, the PRSV was the best predictor of three out of four criteria (MRTC--Year I, SAT, EPSR--Year II), significant at the .01 level. It should be noted that the PRSV was comprised of two parts, Auditory Comprehension and Spoken Language. Weerdenburg (1983)

found that the PRSV was the best indicator of the Metropolitan Readiness Test--Quantitative Score (MRTQ) and MRT--Language criteria. The present study found the PRSV to be the best predictor of the SAT (41.4% of the variance) followed by the MRTC (37.7% of the variance). It also was the best predictor of the EPSR accounting for 33.8% of the variance. The PRSV was not a significant predictor of the EPSM criterion. Since the PRSV was an adequate measure to predict readiness for grade one, then that subtest need only be administered in combination with other subtests or tests found to be good predictors of future performance. This conclusion concurs with that of Weerdenburg (1983).

The second best predictor was the Auditory Input (AI) subtest of the Visual Aural Digit Span Test (VADS). This subtest accounted for the second most variance with three of the four criteria (MRTC--Year I, SAT, EPSR--Year II), significant at the .01 level. The AI was most effective in predicting the MRTC adding 13.3% to raise the explained variance in Year I to 51.0%. Also, AI was the second best predictor of the SAT adding 9.4% to the explained variance to increase it in Year II to 50.8%. With the EPSR, the AI added 9.4% to raise the explained variance to 40.2%. The Aural Input subtest was a combination score of the Aural-

Oral (AO) and Aural Written (AW) subtests of the VADS. Koppitz (1977) reported that the combined scores of the VADS had higher correlations with school achievement than did the four subtests (AO, VO, AW, VW) in isolation. This was found to be the case in the present study as well. Koppitz also claimed that the Visual-Oral subtest was most closely related to reading since it involved integration of visual symbols with sounds and recall of visually presented symbol sequences. This claim was not supported in the present study. Rather, the AW and AO subtests were more closely related, achieving correlations of .41 and .37 respectively. The VO subtest was correlated .17 with EPSR and VW achieved a correlation of .37 with the EPSR. With the SAT reading criterion, the AO had a correlation of .24; the VO had .30; the AW achieved a correlation of .41; and VW had .36. Again, the Aural Written subtest was more highly related to reading than either of the visual subtests. It may be that the auditory ability identified by the AI and PRSV was a significant factor underlying readiness for academic achievement. Stewart (1978) indicated that readiness skills may involve different and more basic skills than investigators had previously considered. Since the AI also was an adequate predictor of readiness for grade

one, then that subtest of the VADS test may be administered alone and combined with the PRSV to form the beginning of a test battery.

A third significant predictor variable was the MRTQ subtest of the Metropolitan Readiness Test. It added to the explained variance with all Year II criteria (SAT, EPSR, EPSM) at a .01 level of significance. The MRTQ was the third variable contributing 5.3% to raise the total variance accounted for to 56.0% with the SAT criterion. It added 4.9% to raise the explained variance to 26.6% with the EPSM. (The INTRA subtest of the VT was the strongest predictor of the EPSM contributing 21.7% to the explained variance.) The MRTQ also added 2.0% to raise the explained variance to 43.2% with the EPSR.

The fourth variable to contribute significantly was the MRTV. It added to the explained variance with the criteria SAT and EPSM at a .01 level of significance. The MRTV was a stronger predictor of the EPSM adding 5.6% to raise the total variance to 32.1%. It also added 3.7% to increase the total variance with the SAT to 61.4%. A final variable, the OE subtest of the VADS, contributed 1.3% to increase the variance with the Year I MRTC to 52.3%. Both of these predictor variables were significant at the .01

level as well.

Rather than adding three subtests of the MRTC to a predictive battery, the total MRTC may be a better predictor. The MRTC accounted for 56.8% of the variance with the SATA, 52.7% of the variance with the SATT, 34.8% of the variance with the EPSR, and 16.5% of the variance with the EPSM. In contrast, the MRTQ, MRTV, MRTR added a total of 10.6% to the explained variance with SATT, the MRTQ added 2.0% to the variance accounted for with the EPSR, and the MRTQ and MRTV added only 10.4% to the total variance with the EPSM. It was concluded that the total MRTC was a better predictor of readiness for grade one, thus, should become part of the test battery along with the PRSV and AI subtests. This conclusion was supported by the research of Weerdenburg (1983) and Reynolds (1979). Both researchers found the MRTC to be a useful instrument for predicting early school achievement.

The issue of skills versus processes as important prerequisites for formal learning was one of long standing. The literature revealed a shift from norm-referenced tests toward criterion-referenced instruments. Wendt (1978) made reference to two types of criterion tests. The "criterion-academic" measure with its emphasis upon specific objectives

and pupil outcomes has often been referred to as the "skills orientation" to learning (Hoskinsson, 1977; Salvia & Ysseldyke, 1981). The second type and more recent criterion-referenced test Wendt (1978) referred to as "criterion-cognitive developmental". An emphasis was placed upon modalities essential to learning higher order tasks. This type of criterion-referenced test has been referred to as the "process orientation" (Salvia & Ysseldyke, 1981). The question raised has been whether skills or processes were the primary prerequisite to the learning process for kindergarten children.

In the present study, all subtests of the MRTC were employed as measures of skills and all subtests of the VADS were used as measures of processes. All variables were ranked according to the results of discriminant function analysis with actual pass/fail achievement as the criterion. Listing of skills variables separately from process variables showed not only their ranking but also their clustering. The results indicated that (a) the largest number of children would be accurately classified using process variables with an auditory component, (b) both skills and process variables with an auditory component have the greatest power to influence predictions, (c) the MRTC skills variables

clustered as the second most powerful influence on predictions, and (d) the VADS process variables, excluding those with an auditory component, have the least power to influence predictions. It should be noted that the Visual-Oral and Visual-Input process subtests were the lowest ranked predictor variables out of a total of 18 variables.

Muehl and Kremenak (1966) found that auditory-auditory tasks were the most difficult and that auditory-visual, as well as visual-auditory measures, were significant independent predictors of grade one reading achievement. The present study did not support the use of visual predictor variables. Katz and Deutsch (1964) found that (a) both good and poor readers performed equally well on visual tasks in grade one, and (b) poor auditory perception was indicative of poor readers by the third to fifth grades. Researchers have recommended early diagnosis of reading problems and implementation of auditory attention training (Katz & Deutsch, 1964; Reilly, 1971). The present findings supported the recommendations of these earlier studies given that auditory processes appeared to be important prerequisites of readiness for grade one. It must be noted, however, that sensory skills develop rapidly between the ages of five to seven and more rapidly for girls than boys

(Derevensky, 1977; Reilly, 1971; Satz & Friel, 1964).

It was considered important to assess those factors or constructs kindergarten teachers considered to be indicative of readiness for grade one. The results indicated that 10 out of 11 kindergarten teachers considered both listening abilities (auditory) and a positive self-concept to be of equal importance. This was followed by the ability to use spoken language to communicate ideas and feelings to others; a view shared by 7 of 11 teachers. Although the sample of kindergarten teachers was small, there seemed to be a relationship between what the Pupil Rating Scale--Verbal Score (PRSV) subtest measures (Auditory Comprehension and Spoken Language) and what the kindergarten teachers expressed as important readiness constructs (Listening and Communication Abilities). The PRSV was a strong predictor of the Year I criterion MRTC and the Year II criteria SATT and EPSR. It would seem reasonable to conclude that a real relationship did exist since these same kindergarten teachers completed the Pupil Rating Scales for the pupil sample. None of the other kindergarten teacher constructs appeared with enough frequency to be of any potential importance.

Nadon (1983) stated that psychometric approaches to prediction have been based upon the notion that knowledge

of a child's cognitive, physical, social, and emotional functioning will yield data that is predictive of future performance. The kindergarten teachers categorized their constructs under similar labels (background, intellectual, physical, social, and emotional). The inclusion of the background category supported the views of Feshbach, Adelman, and Fuller (1977) that intervening variables such as "the home" may have an impact upon child development, thus, cannot be ignored. The present results revealed that the social behavior category was ranked as the most important set of constructs. Similarly, Perry, Guidubaldi, and Kehle (1979) found that kindergarten teacher ratings of social competence was a better predictor of later school performance than ratings of intellectual abilities and behavior. These findings have been corroborated by Feshbach, Adelman, and Fuller (1977), and Stevenson, Parkes, Wilkinson, Hegion, and Fish (1976). The rank order of the remaining kindergarten teacher categories were: intellectual, emotional, and background, and physical behavior.

The kindergarten teachers' readiness constructs (KTRC) were compared to the Pupil Rating Scale constructs (PRSC) to determine whether a relationship existed. The rationale for the comparison was that a majority of recent studies in

the literature provided evidence that teachers were surprisingly accurate predictors of future achievement (Cowgill, Friedland, & Shapiro, 1973; Feshback, Adelman, & Fuller, 1974; Glazzard, 1977; Glazzard, Tollefson, Selders, & Barke, 1982; Keogh, Tchir, & Windeguth-Behn, 1974; Kermoian, 1962; Stevenson, Parker, Wilkinson, Hegion, & Fish, 1976). In fact, many researchers reported that teacher evaluations of kindergarten pupils were as good as, if not better than, standardized test results for placement decisions or predicting future achievement (Colarusso, Mathis, & Shessel, 1977; Glazzard, 1977; Lindsay & Wedell, 1982; Weerdenburg, 1983).

A total of 53 KTRC were matched with the 24 PRSC. Some KTRC were matched to more than one PRSC. In some cases, the KTRC were overly general or the PRSC were very specific. As a result only 13 KTRC were successfully equated with 18 of the PRSC. There were no KTRC for 6 of the PRSC. With such a small sample of kindergarten teachers these results cannot be considered as conclusive evidence that a relationship existed between the KTRC and PRSC. It would seem that a degree of relationship may exist but the exact degree of the relationship cannot be determined by the present data. Further, the fact that the kindergarten teachers submitted

53 constructs was a direct result of the open-ended request for constructs. The teachers were asked to submit a list of those factors they deemed essential to success in grade one. The responses varied from as few as 4 to as many as 27.

Implications for Psychologists

The purpose of screening has been the early identification of children "at risk" of having learning problems. Educators now realize that remediation of older children has been a slow, costly, and often fruitless endeavor. Both Dunn (1968) and Slingerland (1969) argued that emphasis should be placed upon diagnoses and intervention rather than on procedures of identification, classification, and placement. Their rationale was that these children should derive some benefit from the screening procedures. The psychologist needs to not only diagnose the type and extent of the learning problem but needs to provide the educator with practical intervention strategies if preventive education is to be successfully implemented. This would suggest that psychologists have knowledge of a variety of intervention strategies for a variety of learning problems.

The fact that the development of children between the ages of five to seven can fluctuate rapidly is well known.

Children that appear to be "at risk" of experiencing learning problems may suddenly progress rapidly. Conversely, children "not at risk" of learning problems may suddenly make slow progress. Psychologists need to be sensitive to these fluctuation possibilities when interpreting test results. It may be that he/she simply recommends that the educator observe the child's performance for a specified period and reassesses the child at some later time. Or, the psychologist may recommend immediate intervention strategies be implemented. It is the opinion of the present writer that if any doubt regarding future success arises, then intervention strategies be immediately implemented. The rationale for this practice is that overlearning will do no harm to a child, whereas delayed intervention may result in long term learning problems with associated negative side effects (Wilborn & Smith, 1974). The benefit of early intervention can increase a child's chances of success.

The results of the present study indicated that auditory abilities are essential to readiness for school entry. Kindergarten teachers considered listening abilities to be an essential factor to success in grade one. Multiple regression analysis revealed that the Pupil Rating Scale--Verbal Score (PRSV) and Auditory Input (AI) subtest of the

Visual Aural Digit Span Test were the best two predictors of future achievement. Both of these subtests measure auditory abilities. Analysis of skills versus process measures revealed that a larger number of children were accurately classified using subtests with an auditory component, regardless of whether they were skills or process oriented. Psychologists are directed to be sensitive to the auditory abilities of the children being screened for identification of learning problems. Katz and Deutsch (1964) investigated auditory and visual learning and found that both good and poor readers experienced more difficulty with recall of auditory items. They stressed the importance of early identification of reading problems, as well as recommending that auditory attention intervention strategies be implemented with primary grade pupils.

The number of children found to have auditory attention deficits appears to be on the increase. It is the opinion of the present writer that this situation may be directly related to the increased amount of time children spend viewing television and video tapes. While the visual attention abilities are being enhanced, auditory attention abilities may be decreasing. Viewers need not be able to comprehend the dialogue to understand the story. As a

result of such social practices, psychologists may find themselves in the position of informing or educating the parent population of the inherent dangers of continuing this practice.

Implications for Educators

Educators have realized that remediation of older children often does not correct the problems as intended. Also, children requiring remediation frequently require such assistance throughout their school careers. The recent emphasis upon early identification and intervention has shifted the focus to the provision of preventive education rather than on remediation of well developed learning problems. The educator, especially the early childhood specialists, must possess or acquire knowledge of a wide variety of learning problems so that they may understand psychological diagnoses, as well as provide appropriate intervention strategies. Psychologists may provide assistance with suggested intervention strategies, but the educator will be responsible for developing or revising current programs to allow for the use of varied intervention strategies. Beyond these requirements, the educator is responsible for implementing, evaluating, and revising such strategies if preventive education is to become a reality.

The present study revealed that auditory abilities were essential to readiness for grade one. Also, auditory measures were found to be highly predictive of future achievement. With an increase in the number of children being identified as being "auditory deficit disordered", it becomes apparent that these children will not be able to succeed in school without adequately developed auditory abilities. Thus, educators need to prepare programs designed to train these children to attend to auditory stimuli (Katz & Deutsch, 1964). Educators need to be aware of the difficulty of auditory processing tasks. Possibly specialists may need to be trained to provide one-to-one auditory therapy similar to the services currently provided by speech therapists.

If the increased viewing of television and videos is in fact negatively affecting the auditory functioning of larger numbers of children, then educators not only need to provide the preventive education to overcome the problem, but may also need to assist the psychologists in educating parents of the negative impact such practices are producing. This may be accomplished at parent-teacher interviews if only a few children are involved. However, if larger numbers of children are being affected, then possibly educators

will require parent-teacher association meetings to inform them of the problem or arrange for a special meeting with parents of the community to share educational concerns.

Because the development of children between the ages of five to seven fluctuate rapidly, educators need to be aware that children who appear "at risk" for learning problems one month may no longer be "at risk" next month and vice versa. Also, educators need to be sensitive to these rapid fluctuations when observing, evaluating, and programming for these children. However, if an educator suspects a child may have a learning problem after a period of close observation, then it is recommended that the child be referred for further assessment in order that the child be provided with intervention strategies at the earliest possible time should they be required. Only when this procedure has been followed can educators be sure that preventive education has been provided.

Implications for Future Research

1. A replication of the study with the same assessment procedures and a different sample would provide evidence to support or refute the use of these tests and subtests as significant predictors of future achievement.

2. A replication of the skills versus processes

analysis would provide evidence to support or refute the present findings which revealed that auditory process and skills subtests were the best predictors of future achievement.

3. Since kindergarten teachers are particularly sensitive in determining which children may develop learning problems in first grade, it would be necessary to repeat the investigation of those factors kindergarten teachers deemed essential to readiness for grade one with a much larger teacher sample. Obtaining permission to approach all kindergarten teachers in the Edmonton Public School System would provide sufficient data to determine which factors were significant in terms of predicting future achievement.

4. A structured format for obtaining the kindergarten teachers readiness factors would be required to improve the management and analysis of the data.

5. A factor analysis of the kindergarten teacher readiness factors would provide better results and more conclusive evidence.

6. The comparison of the kindergarten teachers' readiness factors with those of the Pupil Rating Scale should be repeated with a larger sample to determine

the degree of relationship.

REFERENCES

REFERENCES

Abdin, R. (Ed.) Parent education and intervention handbook. Chicago: Charles C. Thomas, 1980.

Abrahamson, D. S., & Bell, A. E. Assessment of the school readiness section of the early detection inventory: Preschool predition across situational factors. Journal of School Psychology, 1979, 17 (2), 162-171.

Ames, L. B. Learning disabilities: Time to check our roadmaps? Journal of Learning Disabilities, 1977, 10, 328-330.

Anderson, L. S., Griffin, C. L., & Hunt, B. M. Elementary School Guidance & Counseling, 1978, Dec., 93-98.

Ausubel, D. P. In defense of verbal learning. Educational Theory, 1961, 11, 15-25.

Beery, K. E., & Buktenica, N. A. Developmental test of visual motor integration. Chicago: Follett Publishing Co., 1967.

Bender, L. A visual-motor gestalt test in its clinical use. American Orthopsychiatric Association, 1938, Monograph, No. 3.

Birch, H., & Belmont, L. Auditory-visual integration in normal and retarded readers. American Journal of Orthopsychiatry, 1964, 34, 852-861.

Bloom, B. S. Stability and change in human characteristics. New York: Wiley, 1964.

Book, R. M. Predicting reading failure: A screening battery for kindergarten children. Journal of Learning Disabilities, 1974, 7, 43-47.

Book, R. M. Identification of educationally at-risk children during the kindergarten year: A four-year follow-up study of group test performance. Psychology in the Schools, 1980, 17 (2), 153-159.

Bremer, N. D. Do readiness tests predict success in reading? Elementary School Journal, 1959, 59, 222-224.

Bruner, J. S. The process of education. Cambridge: Harvard University Press, 1960.

Bryan, Q. Relative importance of intelligence and visual perception in predicting reading achievement. California Journal of Educational Research, 1964, 15, 44-48.

Bryan, T., & McGrady, H. Use of a teacher rating scale. Journal of Learning Disabilities, 1972, 5, 199-206.

Buckley, P. D. The Bender gestalt test: A review of reported research with school-age subjects, 1966--1977. Psychology in the Schools, 1978, 15 (3), 327-338.

Busch, R. F. Predicting first-grade reading achievement. Learning Disabilities Quarterly, 1980, 3, 38-48.

Buros, O. D. The eighth mental measurement yearbook (Vol. 1, Vol. 2) New Jersey: The Gryphone Press, 1978.

Colarusso, R. P., Mathis, G., & Shessel, D. Teacher effectiveness in identifying high-risk kindergarten children. Journal of Learning Disabilities, 1979, 12 (10), 684-686.

Colarusso, R., Plankenhorn, A., & Brooks, R. Predicting first-grade achievement through formal testing of 5 year-old high-risk children. Journal of Special Education, 1980, 14 (3), 355-363.

Colligan, R. C. Predictive utility of the Myklebust pupil rating scale: A two-year follow up. Journal of Learning Disabilities, 1979, 12 (4), 264-267.

Cowgill, M., Friedland, S., & Shapiro, R. Predicting learning disabilities from kindergarten reports. Journal of Learning Disabilities, 1973, 6 (9), 577-582.

Crain, W. C. Theories of development: Concepts and applications. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1980.

de Hirsh, K., Jansky, J., & Langford, W. Predicting reading failure. New York: Harper & Row, 1966.

Derevensky, J. L. Cross modal functioning and reading achievement. Journal of Reading Behavior, 1977, 9 (3), 233-251.

Dervensky, J. Infant intervention and parent education: The necessity for an interdisciplinary approach. Journal of Education, 1981, 163, 275-281.

Dunn, L. M. Special education for the mildly retarded--Is much of it justifiable? Exceptional Children, 1968, 35, 5-22.

Durkin, D. Teaching young children to read. Boston: Allyn and Bacon, 1972.

Eaves, L. C., Kendell, D. C., & Crichton, J. U. The early identification of learning disabilities: A follow-up study. Journal of Learning Disabilities, 1974, 7, 632-638.

Evans, R. The prediction of educational handicap--A longitudinal study. Educational Research, 1977, 19 (1), 57-68.

Federici, L., Sims, H., & Bashian, A. Use of the Meeting Street School screening test and the Myklebust pupil rating scale with first-grade black urban children. Psychology in the Schools, 1976, 13, 386-389.

Feshback, S., Adelman, H., & Fuller, W. Early identification of children with high-risk of reading failure. Journal of Learning Disabilities, 1974, 7 (10), 639-644.

Feshback, S., Adelman, H., & Fuller, W. Prediction of reading and related academic problems. Journal of Educational Psychology, 1977, 69 (4), 299-308.

Fine, M. (Ed.) Handbook of parent education. New York: Academic Press, 1980.

Flook, W. M., & Valicer, W. F. School readiness and teachers' ratings: A validation study. Psychology in

the Schools, 1977, 14, 140-146.

Flynn, T. M., & Flynn, L. A. Evaluation of the predictive ability of five screening measures administered during kindergarten. Journal of Experimental Education, 1978, 46, 65-70.

Gallerani, D., O'Regan, M., & Reinherz, H. Prekindergarten screening: How well does it predict readiness for first grade? Psychology in the Schools, 1982, 19, 175-182.

Glazzard, M. The effectiveness of three kindergarten predictors for first-grade achievement. Journal of Learning Disabilities, 1977, 10 (2), 95-99.

Glazzard, P., Tollefson, N., Selders, J., & Barke, C. R. The predictive validity of the kindergarten teacher rating scale. Educational & Psychological Measurement, 1982, 42, 687-693.

Goldenberg, D. S. Relationship of screening and diagnostic preschool measures to later school adjustment and achievement measures. Dissertation Abstracts International, 1978, 39 (2-A), 657-658. (University Microfilms No. 62-5)

Gracey, C. A., Azzara, C. U., & Reibherz, H. Screening revisited: A survey of U. S. Requirements. Journal of Special Education, 1984, 18, 101-107.

Gredler, G. R. A look at some important factors in assessing readiness for school. Journal of Learning Disabilities, 1978, 11 (5), 284-290.

Guthrie, E. R. The psychology of learning. New York: Harper & Brothers, 1952.

Hase, H. D. Predicting performance in the first grade with the first grade screening test. Psychology in the Schools, 1977, 14, 407-412.

Hopkins, K. D., & Sitkei, E. G. Predicting grade 1 reading performance: Intelligence vs. reading readiness tests. The Journal of Experimental Education, 1969, 37 (3), 11-13.

Hoskisson, K. Reading readiness: Three viewpoints. The Elementary School Journal, 1977, 78, 44-52.

Hull, C. Principles of behavior. New York: Appleton-Century-Crofts, 1943.

Hunt, J. McV. Intelligence and experience. New York: The Ronald Press, 1961.

Ilg, F. L., & Ames, L. B. School readiness. New York: Harper & Row, 1965.

Jansky, J., & de Hirsch, K. Preventing reading failure: Prediction, diagnosis, intervention. New York: Harper & Row, 1972.

Judkins, J. Courtroom to classroom: A review of mandatory special education legislation. Teaching Atypical Students in Alberta, 1979, 8, 27-31.

Katz, P. A., & Deutsch, M. Modality of stimulus presentation in serial learning for retarded and normal learners. Perceptual & Motor Skills, 1964, 19, 627-633.

Katz, P., & Deutsch, M. Relation of auditory-visual shifting to reading achievement. Perceptual & Motor Skills, 1963, 17, 327-332.

Keogh, B. Pattern copying under three conditions of an expanded spatial field: Questions, cautions, and guidelines. Developmental Psychology, 1971, 4, 25-31.

Keogh, B. K., & Smith, C. E. Early identification of educationally high potential and high risk children. Journal of School Psychology, 1970, 8, 285-290.

Keogh, B., Tchir, C., & Windeguth-Behn, A. Teachers' perceptions of educationally handicapped children. Journal of Learning Disabilities, 1974, 7, 367-374.

Kermoian, S. Teacher appraisal of first-grade readiness. Elementary English, 1962, 39, 196-201.

Kirk, S. A. Early education of the mentally retarded: An experimental study. Urbana: University of Illinois

Press, 1958.

Koppitz, E. M. The Bender-gestalt test for young children (Vol. 2). New York: Greene & Stratton, 1975.

Koppitz, E. M. The visual aural digit span test. New York: Greene & Stratton, 1977.

Kulberg, J., & Gershman, E. School readiness: Studies of assessment procedures and comparison of three types of programming for immature 5-year-olds. Psychology in the Schools, 1973, 10, 410-420.

Langer, J. Theories of development. New York: Holt, Rinehart, & Winston, 1969.

Larsen, S. C., & Hammill, D. D. The relationship of selected visual-perceptual abilities to school learning. Journal of Special Education, 1975, 9, 281-291.

Lehman, J., & Breen, M. J. A comparative analysis of the Bender-gestalt and Beery/Buktenica test of visual-motor integration as a function of grade level for regular education students. Psychology in the Schools, 1982, 19, 52-54.

Lessler, K., & Bridges, J. S. The prediction of learning problems in a rural setting: Can we improve on readiness tests? Journal of Learning Disabilities, 1973, 6 (2), 90-94.

Lindquist, G. T. Preschool screening as a means of predicting later reading achievement. Journal of Learning Disabilities, 1982, 15 (6), 331-332.

Lindsay, G. A., & Wedell, K. The early identification of educationally 'at-risk' children revisited. Journal of Learning Disabilities, 1982, 15 (4), 212-217.

Lipson, A. M. Catching them early. Academic Press, 1981, 16 (4), 457-462.

Madden, N., Gardner, E. F., Rudman, H. C., Karlsen, B., & Merwin, J. C. Stanford achievement test, primary level 1. New York: Harcourt, Brace, Jovanovich, 1971.

Meuhl, S., & Kremenak, S. Ability to match information within and between auditory and visual sense modalities and subsequent reading achievement. Journal of Educational Psychology, 1966, 57, 230-238.

Mitchell, B. C. The MRT as predictors of first-grade achievement. Educational & Psychological Measurement, 1962, 22 (4), 765-772.

Mitzel, H. E. (Ed.) Encyclopedia of educational research (Vol. 3). New York: The Free Press, A division of Macmillan Publishing Co., Inc., 1982.

Morrow, W. R. Factor analysis of WPPSI and screening tests. Unpublished master's thesis, University of Alberta, 1981.

Munn, N. L. The growth of human behavior (3rd ed.). Boston: Houghton Mifflin, 1974.

Myklebust, H. The pupil rating scale: Screening for learning disabilities. New York: Grune & Stratton, 1971.

Nadon, E. T. Early indices of grade one academic performance. Unpublished master's thesis, University of Alberta, 1983.

Nagle, R. J. The predictive validity of the MRT, 1976 edition. Educational & Psychological Measurement, 1979, 39, 1043-1045.

Newcomer, P. L., & Magee, P. Predictive indices of reading failure in learning disabled children. Educational Research Quarterly, 1977, 2 (2), 17-23.

Nurss, J. R., & McGauvran, M. E. Metropolitan readiness test. New York: Harcourt Brace Jovanovich, 1976.

Perry, J., Guidubaldi, J., & Kehle, T. Kindergarten competencies as predictors of third-grade classroom behavior and achievement. Journal of Educational Psychology, 1979, 71 (4), 443-450.

Piaget, J. The theory of stages in cognitive development. Monterey, California: McGraw-Hill, 1969.

Pihl, R. O., & Nagy, K. A. The applicability of the Myklebust pupil rating scale (PRS). Journal of Learning Disabilities, 1980, 13 (2), 58-62.

Porter, G. L., & Binder, D. M. A pilot study of visual-motor development inter-rater reliability: The Beery developmental test of visual motor integration and the Bender visual motor gestalt test. Journal of Learning Disabilities, 1981, 14 (3), 124-127.

Raven, M. A note on the use of screening procedures. Remedial Education, 1981, 16 (1), 341-353.

Reilly, D. H. Auditory-visual integration, sex, and reading achievement. Journal of Educational Psychology, 1971, 62, 482-486.

Reinherz, H., & Griffin, C. L. Identifying children at risk: A first step to prevention. Health Education, 1977, July/Aug., 14-16.

Reynolds, C. R. Differential validity of several preschool assessment instruments for blacks, whites, males, and females. Unpublished doctoral dissertation, University of Georgia, 1978.

Reynolds, C. R., Wright, D., & Wilkinson, W. A. Incremental validity of the test for auditory comprehension of language and the developmental test of visual motor integration. Educational & Psychological Measurement, 1980, 40, 503-507.

Reynolds, M. Trends in special education: Implications for measurement. In W. Hively & M. Reynolds (Eds.), Domain-referenced testing in special education. Minneapolis: Leadership Training Institute/ Special Education, University of Minnesota, 1975.

Rosenthal, R., & Rosnow, R. L. The volunteer subject. New York: John Wiley & Sons, 1975.

Salvia, J., & Ysseldyke, J. E. Assessment in special and remedial education (2nd ed.). Boston: Houghton & Mifflin Company, 1981.

Sattler, J. M. Assessment of children's intelligence and special abilities (2nd ed.). Toronto: Allyn & Bacon, Inc., 1982.

Satz, P., & Fletcher, J. Early screening tests: Some uses and abuses. Journal of Learning Disabilities, 1979, 12, 56-59.

Satz, P., & Fletcher, J. Minimal brain dysfunctions: An appraisal of research concepts and methods. In H. Rie & E. Rie (Eds.), Handbook of minimal brain dysfunctions: A critical review. New York: Wiley Interscience, 1980, 669-714.

Satz, P., & Freil, J. Predictive validity of an abbreviated screening battery. Journal of Learning Disabilities, 1978, 11 (6), 20-24.

Satz, P., & Friel, J. Some predictive antecedents of specific learning disabilities: A preliminary one-year follow up. In P. Satz & J. Ross (Eds.), The disabled learner: Early detection and intervention. Rotterdam: Rotterdam University Press, 1974, 79-97.

Shaw, M. E., & Costanzo, P. R. Theories of social psychology (2nd ed.). New York: McGraw-Hill Book Company, 1982.

Skinner, B. F. Verbal behavior. Englewood Cliffs, N.J.: Prentice-Hall, 1957.

Slingerland, B. Pre-reading screening procedures. Cambridge, Massachusetts: Educators Publishing Service, Inc., 1969.

Solan, H. A. Understanding learning disabilities. In J. R. Lachenmeyer & M. S. Gibbs (Eds.), Psychopathology in Childhood. New York: Gardner Press, Inc., 1982, 189-210.

Stevenson, H. W., Parker, T., Wilkinson, A., Hegion, A., & Fish, E. Predictive value of teachers' ratings of young children. Journal of Educational Psychology, 1976, 68 (5), 507-517.

to correct deficient areas of development in kindergarten students. Dissertation Abstracts International, 1978, 39 (4-A), 2133.

Swanson, B. B., Payne, D. A., & Jackson, B. A predictive validity study of the Metropolitan readiness test and Meeting Street School screening test against first grade Metropolitan achievement test scores. Educational & Psychological Measurement, 1981, 41, 575-578.

Telegdy, G. A. The effectiveness of four readiness tests as predictors of first grade academic achievement. Psychology in the Schools, 1975, 12, 4-11.

Telegdy, G. A. The relationship between socioeconomic status and school readiness. Psychology in the Schools, 1974, 11, 351-356.

Tokar, E. B., & Holthouse, N. D. The validity of the subtests of the 1976 edition of the MRT. Educational & Psychological Measurement, 1977, 37, 1099-1101.

Tyler, F. T. Issues related to readiness to learn. In Theories of learning and instruction, 63rd yearbook of the national society for the study of education. Chicago: University of Chicago Press, 1964, 210-239.

Wallace, G., & Larsen, S. Educational assessment of learning problems: Testing for teaching. Boston: Allyn & Bacon, 1978.

Weerdenberg, G. Predicting grade one success with a selected kindergarten screening battery. Unpublished master's thesis, University of Alberta, 1983.

Wells, M. D., & Peterson, G. V. Kindergarten behavior rating as a predictor of first-grade achievement. Journal of Learning Disabilities, 1978, 11 (6), 344-347.

Wendt, R. N. Kindergarten entrance assessment: Is it worth the effort? Psychology in the Schools, 1978, 15 (1), 56-62.

for reading failure. British Journal of Educational Psychology, 1979, 49, 132-137.

Whiton, M. B., Singer, D. L., & Cook, H. Sensory integration skills as predictors of reading acquisition. Journal of Reading Behavior, 1975, 7 (1), 79-89.

Wilborn, B. L., & Smith, D. A. Early identification of children with learning problesm. Academic Therapy, 1974, 10 (5), 363-371.

Worth, W. H. A report on the Alberta early childhood education study. A presentation by Dr. Walter H. Worth, Professor and Head, Dept. of Elementary Education, University of Alberta, to the sixtieth annual convention of the Alberta School Trustees' Association, Calgary, Alberta, Nov. 8, 1966.

Zettel, J. J., & Weintraub, F. J. PL94-142: Its origins and implications. National Elementary Principal, 1978, 58, 10-14.

CONSENT FORM

I give my consent for my child _____
(Name)
to participate in the research study coordinated by Faith Hambrook at _____ during
(School Name)
kindergarten and grade one.

I understand that no unusual tests will be administered to my child, that my child's performance will be kept confidential, and that I may withdraw from the study at any time I feel there is just cause by contacting the Research Coordinator.

Parent/Guardian Signature _____

My child may NOT participate in this research study

_____
(Child's Name)

_____
(Parent/Guardian's Signature)

Spruce Avenue School
11424 102 Street
Edmonton, Alberta
T5G 2E7

October 21, 1986

Re: Skills Versus Processes In Predicting
Grade One Achievement
(Thesis Project by Faith Hambrook)

Dear

This letter is just a reminder that follow-up testing (of those Kindergarten subjects tested last year) will occur in late April or May by the Grade One teachers. The tests to be administered are: (1) Stanford Achievement Test, (2) EPSB Math, and (3) EPSB Reading.

I will supply the Stanford Achievement Tests forteachers. The scores for the EPSB Math and Reading may be submitted to me or I will score those for my subjects, if you wish. Envelopes will be provided for the return of the S.A.T.

Enclosed you will find 2 copies of student lists for your school. Please update one and return to me at Spruce Avenue School.

If you or your teachers have any questions, please feel free to phone me. HOME 963-3657, SCHOOL 479-0155.

Sincerely,

F. Hambrook

Faith Hambrook

FH/kh

SKILLS VERSUS PROCESSES IN PREDICTING GRADE ONE ACHIEVEMENT
(Thesis Project by Faith Hambrook)

Introduction

Parents and educators likely all would agree that school success is preferable to failure. Some children, however, do have problems beginning in first grade. A few of these continue to have problems. Some eventually end up in special education classes. Several years of experience teaching special education classes has indicated that the benefits of remediation are limited. A search of the literature indicated that remediation is a time-consuming, costly, and often fruitless endeavor. School boards have begun to seek alternatives.

Prevention rather than remediation seemed to be the alternative. To provide preventive education means early identification of children prior to experiences of failure. Kindergarten has become the target age group.

Successful early identification is dependent upon selection of the best available predictive tests. The battery of tests selected for this study were chosen for their high predictive ability with kindergarten children.

The primary purpose of this study is to determine whether this particular test battery can successfully predict the future performance of kindergarten children. Secondary purposes are: (a) to determine whether the skills a child has or the processes he/she uses are the more important prerequisite to academic success, (b) to determine what kindergarten teachers' deem to be the essential readiness factors for school success (since they are the best predictors of future performance), and (c) to determine how schools can use such information to assist children become more successful.

Procedure

NOTE: Children with severe mental and physical handicaps and E.S.L. students are excluded from this study because they are more easily identified at an early age.

The order of the tasks in this study is important. The purpose of ordering the tasks was intended to avoid influencing teacher responses on the first two tasks.

NOVEMBER 30, 1985

Kindergarten teachers are asked to make a list of those readiness factors they deem to be essential for academic success. Draw upon your experiences and observations of kindergarten children. It is asked that your list be compiled independently and not discussed with other kindergarten teachers. Names are not required on these lists. Please send these lists to Faith Wambrook at Spruce Avenue School via Truck. Envelopes will be supplied for this purpose.

APRIL 15, 1986

Complete a Pupil Rating Scale for each subject in your class using any information you have gained. If you have not received copies of this Scale by the end of March, please phone me. No scoring is required. Again, forward the Scales to me in the envelopes provided.

APRIL 30, 1986

Administer the Metropolitan Readiness Test to small groups of subjects. Copies of this test will be provided when the Pupil Rating Scale has been submitted. No scoring is required. Again, forward the tests to me in the envelopes provided.

APRIL 1986 ??

Students, who have graduated from the testing course, will administer the Beery Visual-Motor Test and the Visual Aural Digit Span Test. 20 minutes per student is required. These students will arrange with the kindergarten teacher for testing dates and times. These tests will be submitted to me for scoring.

MAY 1987 ??

Grade one teachers are asked to administer the Stanford Achievement Test to all subjects in small groups. Copies of these tests will be provided by the end of April. No scoring will be required. Forward these tests to me at the above school in the envelopes provided.

Parent permission slips may be ~~kept at the school~~. They will be collected and lists of subjects made for the teachers. Your cooperation will be appreciated.

Questions?????

March 1, 1986.

Re: Skills versus Processes in Predicting Grade One Achievement - Faith Hambrook's Thesis.

Dear

I apologize for the use of a form letter, but one teacher has not yet sent me a list of readiness factors. Since I requested anonimity, I am unable to directly contact this teacher. I urge you to submit this list as soon as possible, otherwise many other schools may be inconvenienced by the delay. Part of the thesis design was that I receive the readiness factor lists prior to mailing of the rating scales. Rating scales are due to be mailed out by the end of March. If you have mailed your list to me, I thank you for your prompt response.

I am in the process of making lists of students with parental permission for your use, but find that two schools have not yet sent me any forms. I realize that one of the forms I distributed earlier this year asked that you hold permission slips for pick-up. If you are holding these consent forms, would you please forward them to Faith Hambrook at Spruce Avenue School.

Arrangements have been made for graduate students to administer tests, however, these students requested a delay from late April until early May because of their final exams at University. The final exam is scheduled for April 25, 1986. If assessments in early May are too much of an inconvenience, please contact me at Home 963 3657 or School 479 0155 and other arrangements will be made.

I will be contacting each of you within the next three weeks to confirm the number of graduate students required for administration of the Metropolitan Readiness Test. I will need information, also, about available space for these students to conduct the assessments. At this time, I hope to be able to supply you with the names of the students assigned to your school and the time and dates of their arrival.

I would appreciate your having discussed the matter of testing space and the later testing date proposed with your principal before I call for confirmation. Thank you for your assistance in these matters.

Yours truly,

Hambrook

Faith Hambrook

April 13, 1987

Dear Teachers,

The follow-up testing for Faith Hambrook's thesis involves the administration of the Stanford Achievement Test, in addition to the E.P.S.B. Math and Reading tests, during the Spring (Late April--Mid June) of 1987. Enclosed are: (1) Stanford Achievement tests, (2) an Administration Manual, and a return envelope.

It is essential that I be able to get the E.P.S.B. Math and Reading scores before year-end or sooner. I am willing to score tests of subjects if there is any doubt about the return of scores before year-end.

Also, enclosed is a list of subjects that have moved to other schools within Edmonton Public School System. Should they be in your school, please include them in the testing. Parental permission has been obtained for all subjects listed.

If you have any concerns, please feel free to call me at SCHOOL: 479 0155 or HOME: 963 3657.

I am aware of the extra time and effort that is required and do wish to thank you for your assistance.

Sincerely,

F. Hambrook

Faith Hambrook

FH/kh

APPENDIX A

AN ABBREVIATED LISTING OF

CRITERION AND PREDICTOR VARIABLES

AN ABBREVIATED LISTING OF

CRITERION AND PREDICTOR VARIABLES

Predictor Variables

SEX	Sex
AGE	Age (in months)
PRSA	Pupil Rating Scale (Auditory Subscore)
PRSS	Pupil Rating Scale (Spoken Language)
PRSO	Pupil Rating Scale (Orientation)
PRSM	Pupil Rating Scale (Motor Coordication)
PRSP	Pupil Rating Scale (Personal-Social Behavior)
PRSV	Pupil Rating Scale (Verbal Score)
PRSN	Pupil Rating Scale (Nonverbal Score)
PRST	Pupil Rating Scale (Total Scale Score)
VMI	Developmental Test of Visual Motor Integration
AO	Visual Aural Digit Span Test (Aural-Oral)
VO	Visual Aural Digit Span Test (Visual-Oral)
AW	Visual Aural Digit Span Test (Aural-Written)
VW	Visual Aural Digit Span Test (Visual-Written)
AI	Visual Aural Digit Span Test (Aural Input)
VI	Visual Aural Digit Span Test (Visual Input)
OE	Visual Aural Digit Span Test (Oral Expression)
WE	Visual Aural Digit Span Test (Written Expression)
INTRA	VADS Test (Intra-sensory Integration)
INTER	VADS Test (Inter-sensory Integration)

VADS VADS Test (Total Score)

MRTA Metropolitan Readiness Test (Auditory Memory)

MRTR Metropolitan Readiness Test (Rhyming Subscore)

MRTLR Metropolitan Readiness Test (Letter Recognition)

MRTVM Metropolitan Readiness Test (Visual Matching)

MRTS Metropolitan Readiness Test (School Language and Listening)

MRTQ Metropolitan Readiness Test (Quantitative Language)

MRTV Metropolitan Readiness Test (Visual Score)

MRTL Metropolitan Readiness Test (Language Score)

MRTC Metropolitan Readiness Test (Composite Score)

Criterion Variables

MRT Metropolitan Readiness Test (criterion in K year)

SATA Stanford Achievement Test (Auditory Subscore)

SATR Stanford Achievement Test (Reading Subscore)

SATM Stanford Achievement Test (Math Subscore)

SATT Stanford Achievement Test (Total Score)

EPSD Edmonton Public School (Decoding Subscore)

EPSC Edmonton Public School (Comprehension Subscore)

EPSR Edmonton Public School (Reading Score)

EPSM Edmonton Public School (Math Score)

ACH Achievement (actual K and Grade 1 pass-fail)

APPENDIX B

SUMMARY OF DESCRIPTIVE STATISTICS

TABLE A

KINDERGARTEN YEAR

Variable	Number	Mean	Standard Deviation
SEX	235	1.45	.50
AGE	235	69.26	3.79
PRSA	235	13.12	3.01
PRSS	235	15.93	3.84
PRSO	235	12.89	2.77
PRSM	235	9.80	2.34
PRSP	235	26.59	5.68
PRSV	235	29.04	6.68
PRSN	235	49.29	9.55
PRST	235	78.33	15.45
VMI	235	9.84	2.19
AO	235	4.03	.78
VO	235	3.53	1.41
AW	235	2.89	1.42
VW	235	2.89	1.59
AI	235	6.92	1.85
VI	235	6.43	2.61
OE	235	7.56	1.78
WE	235	5.79	2.79
INTRA	235	6.92	1.97

Table A Continued

Variable	Number	Mean	Standard Deviation
INTER	235	6.43	2.42
VADS	235	13.35	4.08
MRTA	235	8.77	2.81
MRTR	235	10.57	2.74
MRTLR	235	10.26	1.50
MRTVM	235	11.89	2.12
MRTS	235	12.10	2.13
MRTQ	235	8.76	1.82
MRTV	235	22.15	3.06
MRTL	235	20.86	3.46
MRTC	235	62.30	9.06

TABLE B

GRADE ONE YEAR

Variable	Number	Mean	Standard Deviation
SATA	112	45.37	8.75
SATR	112	104.82	27.13
SATM	112	43.77	9.91
SATT	112	193.69	40.67
EPSD	112	40.90	8.39
EPSC	112	35.84	9.55
EPSR	112	76.84	17.07
EPSM	112	52.54	7.98

TABLE C

MEANS AND STANDARD DEVIATIONS OF ALL VARIABLES

Variable	Boys (N=62) $\bar{X}$	sd	Girls (N=50) $\bar{X}$	sd	Total (N=112) $\bar{X}$	sd
PRSA	12.87	2.69	13.38	2.71	13.12	3.01
PRSS	15.73	3.36	15.82	3.22	15.93	3.84
PRSO	12.56	2.43	13.16	2.61	12.89	2.77
PRSM	9.32	2.02	9.46	1.62	9.80	2.34
PRSP	25.34	4.69	27.18	5.12	26.59	5.68
PRSV	28.60	5.83	29.20	5.80	29.04	6.68
PRSN	47.23	8.23	49.80	8.52	49.29	9.55
PRST	75.83	13.37	79.00	13.53	78.33	15.45
VMI	10.23	2.34	9.50	1.79	9.84	2.19
AO	4.08	.78	4.12	.69	4.03	.78
VO	3.66	1.34	3.64	1.37	3.53	1.41
AW	2.82	1.45	3.08	1.52	2.89	1.42
VW	2.97	1.44	2.88	1.86	2.89	1.59
AI	6.90	1.81	7.20	1.85	6.92	1.85
VI	6.63	2.21	6.52	2.91	6.43	2.61
OE	7.74	1.56	7.74	1.66	7.56	1.78
WE	5.79	2.75	5.96	3.10	5.79	2.79
INTRA	7.05	1.81	7.00	2.11	6.92	1.97
INTER	6.48	2.25	6.72	2.43	6.43	2.42
VADS	13.53	3.64	13.72	4.28	13.35	4.08
MRTA	8.45	3.02	9.06	2.42	8.77	2.81
MRTR	10.85	2.78	10.56	2.76	10.57	2.74
MRTLR	10.44	1.31	10.34	1.17	10.26	1.50
MRTVM	12.26	1.77	12.14	1.46	11.89	2.12
MRTS	12.21	2.02	12.44	1.78	12.10	2.13
MRTQ	8.82	1.80	9.18	1.67	8.76	1.82
MRTV	22.69	2.63	22.48	1.88	22.15	3.06
MRTL	21.03	3.38	21.62	3.00	20.86	3.46
MRTC	63.03	9.26	63.72	7.22	62.30	9.06

TABLE D

DIFFERENCES IN MEANS (MALES VERSUS FEMALES)

Variable	Males	Females	T	p
PRSA	12.87	13.38	-0.99	.323
PRSS	15.73	15.82	-0.15	.881
PRSO	12.56	13.16	-1.25	.216
PRSM	9.32	9.46	-0.39	.697
PRSP	25.34	27.18	-1.98	.050
PRSV	28.60	29.20	-0.55	.586
PRSN	47.23	49.80	-1.62	.108
PRST	75.83	79.00	-1.24	.216
VMI	10.23	9.50	1.81	.073
AO	4.08	4.12	-0.28	.780
VO	3.66	3.64	-0.08	.934
AW	2.82	3.08	-0.91	.364
VW	2.97	2.88	0.28	.799
AI	6.90	7.20	-0.85	.395
VI	6.63	6.52	0.22	.827
OE	7.74	7.74	0.01	.995
WE	5.79	5.96	-0.31	.759
INTRA	7.05	7.00	0.13	.986
INTER	6.48	6.72	-0.53	.594
VADS	13.53	13.72	-0.25	.802

Table D Continued

Variable	Males	Females	T	p
MRTA	8.45	9.06	-1.16	.250
MRTR	10.85	10.56	0.56	.576
MRTLR	10.44	10.34	0.40	.689
MRTVM	12.26	12.14	0.38	.706
MRTS	12.21	12.44	-0.63	.528
MRTQ	8.82	9.18	-1.08	.283
MRTV	22.69	22.48	0.50	.618
MRTL	21.03	21.62	-0.96	.338
MRTC	63.03	63.72	-0.43	.668
SATA	44.71	46.72	-1.20	.232
SATR	106.00	110.70	-0.92	.361
SATM	43.47	43.12	0.18	.859
SATT	194.31	200.60	-0.83	.409
EPSD	39.66	42.00	-1.53	.130
EPSC	34.31	37.34	-1.68	.096
EPSR	73.97	79.60	-1.75	.083
EPSM	52.31	53.16	-0.57	.568

APPENDIX C

PEARSON CORRELATION COEFFICIENTS:

INTERCORRELATIONS OF PREDICTOR VARIABLES

AND CRITERION VARIABLES

TABLE E

PEARSON CORRELATION COEFFICIENTS

	AGE	PRSA	PRSS	PRSO	PRSM	PRSP	PRSV	PRSN
SEX	-.030	.156 **	.113 *	.182 **	.057	.252 ***	.136 *	.216 ***
AGE		.088	.113 *	.098	.172 **	.112 *	.105	.137 *
PRSA			.895 ***	.812 ***	.554 ***	.766 ***	.966 ***	.826 ***
PRSS				.749 ***	.464 ***	.712 ***	.980 ***	.754 ***
PRSO					.639 ***	.729 ***	.797 ***	.880 ***
PRSM						.552 ***	.517 ***	.758 ***
PRSP							.756 ***	.941 ***
PRSV								.807 ***

	PRST	VMI	AO	VO	AW	VW	AI	VI
SEX	.192 **	-.032	.042	-.023	.086	.049	.084	.018
AGE	.130 *	.165 **	.143 *	.121 *	.051	.104	.100	.129 *
PRSA	.928 ***	.329 ***	.316 ***	.440 ***	.402 ***	.402 ***	.442 ***	.482 ***
PRSS	.889 ***	.283 ***	.257 ***	.423 ***	.339 ***	.350 ***	.368 ***	.442 ***

Table E Continued

	OE	WE	INTRA	INTER	VADS	MRTA	MRTR	MRTLR
SEX	-.003	.072	.057	.037	.049	.026	-.023	.087
AGE	.157 **	.085	.141 *	.101	.128 *	.159 **	.021	.017
PRSA	.486 ***	.433 ***	.451 ***	.490 ***	.509 ***	.427 ***	.461 ***	.352 ***
PRSS	.448 ***	.372 ***	.386 ***	.444 ***	.449 ***	.392 ***	.480 ***	.306 ***

	MRTVM	MRTS	MRTQ	MRTV	MRTL	MRTC	SATA	SATR
SEX	.021	.017	.068	.057	.045	.033	.066	.005
AGE	.127 *	.207 ***	.175 **	.096	.221 ***	.166 **	-.000	.058
PRSA	.341 ***	.449 ***	.402 ***	.409 ***	.487 ***	.594 ***	.483 ***	.410 ***
PRSS	.335 ***	.495 ***	.442 ***	.382 ***	.537 ***	.602 ***	.516 ***	.419 ***

	SATM	SATT	EPSD	EPSC	EPSR	EPSM
SEX	-.030	.017	.116	.139	.142	.067
AGE	.073	.068	.004	-.024	-.022	-.056
PRSA	.470 ***	.504 ***	.526 ***	.514 ***	.544 ***	.235 **
PRSS	.505 ***	.523 ***	.508 ***	.544 ***	.555 ***	.223 **

Table E Continued

	PRST	VMI	AO	VO	AW	VW	AI	VI
PRSO	.889 ***	.332 ***	.235 ***	.319 ***	.320 ***	.290 ***	.344 ***	.348 ***
PRSM	.692 ***	.345 ***	.209 ***	.272 ***	.307 ***	.267 ***	.323 ***	.309 ***
PRSP	.908 ***	.261 ***	.272 ***	.298 ***	.329 ***	.342 ***	.367 ***	.369 ***
PRSV	.931 ***	.311 ***	.291 ***	.442 ***	.377 ***	.383 ***	.411 ***	.472 ***
PRSN	.967 ***	.336 ***	.281 ***	.336 ***	.363 ***	.353 ***	.397 ***	.396 ***
PRST		.342 ***	.299 ***	.399 ***	.387 ***	.384 ***	.423 ***	.449 ***
VMI			.233 ***	.270 ***	.330 ***	.361 ***	.352 ***	.365 ***
AO				.250 ***	.363 ***	.291 ***	.700 ***	.312 ***
VO					.472 ***	.515 ***	.467 ***	.853 ***
AW						.722 ***	.919 ***	.694 ***
VW							.676 ***	.887 ***
AI								.664 ***

Table E Continued

	OE	WE	INTRA	INTER	VADS	MRTA	MRTR	MRTLR
PRSO	.353 ***	.328 ***	.328 ***	.372 ***	.379 ***	.324 ***	.341 ***	.278 ***
PRSM	.306 ***	.308 ***	.299 ***	.337 ***	.344 ***	.368 ***	.274 ***	.246 ***
PRSP	.353 ***	.362 ***	.385 ***	.365 ***	.402 ***	.353 ***	.360 ***	.266 ***
PRSV	.477 ***	.409 ***	.426 ***	.477 ***	.488 ***	.418 ***	.484 ***	.335 ***
PRSN	.387 ***	.385 ***	.397 ***	.407 ***	.433 ***	.394 ***	.380 ***	.299 ***
PRST	.445 ***	.415 ***	.429 ***	.458 ***	.479 ***	.424 ***	.444 ***	.329 ***
VMI	.316 ***	.374 ***	.385 ***	.350 ***	.393 ***	.302 ***	.363 ***	.187 **
AO	.638 ***	.350 ***	.633 ***	.357 ***	.517 ***	.353 ***	.326 ***	.237 ***
VO	.904 ***	.533 ***	.516 ***	.857 ***	.758 ***	.409 ***	.256 ***	.335 ***
AW	.532 ***	.919 ***	.728 ***	.859 ***	.861 ***	.420 ***	.355 ***	.393 ***
VW	.537 ***	.937 ***	.925 ***	.721 ***	.874 ***	.364 ***	.306 ***	.355 ***
AI	.677 ***	.852 ***	.826 ***	.808 ***	.878 ***	.471 ***	.409 ***	.401 ***
VI	.814 ***	.858 ***	.842 ***	.902 ***	.941 ***	.442 ***	.324 ***	.397 ***
OE		.576 ***	.688 ***	.837 ***	.828 ***	.481 ***	.346 ***	.371 ***

Table E Continued

	MRTV	MRTS	MRTQ	MRTV	MRTL	MRTC	SATA	SATR
PRSO	.275 ***	.387 ***	.286 ***	.327 ***	.388 ***	.464 ***	.296 ***	.226 **
PRSM	.229 ***	.255 ***	.168 **	.279 ***	.245 ***	.385 ***	.301 ***	.242 **
PRSP	.299 ***	.318 ***	.304 ***	.338 ***	.355 ***	.469 ***	.385 ***	.332 ***
PRSV	.346 ***	.488 ***	.436 ***	.405 ***	.529 ***	.615 ***	.514 ***	.425 ***
PRSN	.314 ***	.364 ***	.304 ***	.364 ***	.383 ***	.507 ***	.379 ***	.314 ***
PRST	.344 ***	.436 ***	.377 ***	.400 ***	.466 ***	.579 ***	.456 ***	.378 ***
VMI	.323 ***	.343 ***	.309 ***	.315 ***	.373 ***	.455 ***	.284 ***	.257 ***
AO	.356 ***	.302 ***	.245 ***	.364 ***	.313 ***	.451 ***	.392 ***	.237 **
VO	.319 ***	.279 ***	.325 ***	.386 ***	.342 ***	.464 ***	.260 ***	.295 ***
AW	.315 ***	.315 ***	.318 ***	.411 ***	.361 ***	.514 ***	.417 ***	.411 ***
VW	.327 ***	.252 ***	.301 ***	.401 ***	.313 ***	.458 ***	.336 ***	.360 ***
AI	.293 ***	.369 ***	.347 ***	.469 ***	.409 ***	.584 ***	.494 ***	.425 ***
VI	.371 ***	.304 ***	.358 ***	.452 ***	.375 ***	.529 ***	.352 ***	.387 ***
OE	.409 ***	.352 ***	.364 ***	.465 ***	.407 ***	.565 ***	.388 ***	.349 ***

Table E Continued

	SATM	SATT	EPSD	EPSC	EPSR	EPSM
PRSO	.341 ***	.305 ***	.410 ***	.434 ***	.442 ***	.180 *
PRSM	.340 ***	.317 ***	.334 ***	.406 ***	.390 ***	.198 **
PRSP	.412 ***	.413 ***	.495 ***	.496 ***	.519 ***	.291 ***
PRSV	.501 ***	.527 ***	.533 ***	.548 ***	.568 ***	.235 **
PRSN	.417 ***	.401 ***	.487 ***	.511 ***	.523 ***	.268 ***
PRST	.474 ***	.476 ***	.533 ***	.555 ***	.571 ***	.268 ***
VMI	.395 ***	.331 ***	.172 *	.328 ***	.262 **	.257 ***
AO	.353 ***	.342 ***	.333 ***	.368 ***	.369 ***	.284 ***
VO	.420 ***	.368 ***	.153	.169 *	.172 *	.287 ***
AW	.485 ***	.485 ***	.368 ***	.424 ***	.414 ***	.379 ***
VW	.502 ***	.440 ***	.330 ***	.380 ***	.371 ***	.378 ***
AI	.525 ***	.527 ***	.434 ***	.494 ***	.486 ***	.412 ***
VI	.543 ***	.477 ***	.294 ***	.335 ***	.330 ***	.398 ***
OE	.497 ***	.456 ***	.280 ***	.309 ***	.312 ***	.360 ***

Table E Continued

	INTRA	INTER	VADS	MRTA	MRTR	MRTLR	MRTVM	MRTS
WE	.897 ***	.847 ***	.935 ***	.421 ***	.354 ***	.401 ***	.346 ***	.303 ***
INTRA		.726 ***	.913 ***	.435 ***	.377 ***	.381 ***	.406 ***	.324 ***
INTER			.943 ***	.483 ***	.356 ***	.424 ***	.369 ***	.346 ***
VADS				.497 ***	.393 ***	.436 ***	.415 ***	.362 ***
MRTA					.391 ***	.208 ***	.311 ***	.392 ***
MRTR						.241 ***	.379 ***	.465 ***
MRTLR							.409 ***	.273 ***
MRTVM								.378 ***

	MRTQ	MRTV	MRTL	MRTC	SATA	SATR	SATM	SATT
WE	.333 ***	.437 ***	.361 ***	.522 ***	.402 ***	.412 ***	.528 ***	.495 ***
INTRA	.341 ***	.469 ***	.377 ***	.550 ***	.432 ***	.391 ***	.549 ***	.500 ***
INTER	.375 ***	.464 ***	.410 ***	.570 ***	.413 ***	.430 ***	.545 ***	.517 ***
VADS	.387 ***	.502 ***	.425 ***	.603 ***	.455 ***	.445 ***	.589 ***	.549 ***
MRTA	.373 ***	.318 ***	.438 ***	.700 ***	.494 ***	.388 ***	.427 ***	.475 ***

Table E Continued

	EPSD	EPSC	EPSR	EPSM
WE	.374 ***	.431 ***	.421 ***	.406 ***
INTRA	.404 ***	.459 ***	.452 ***	.420 ***
INTER	.325 ***	.370 ***	.365 ***	.406 ***
VADS	.392 ***	.446 ***	.439 ***	.445 ***
MRTA	.386 ***	.467 ***	.457 ***	.291 ***

	MRTQ	MRTV	MRTL	MRTC	SATA	SATR	SATM	SATT
MRTR	.427 ***	.381 ***	.511 ***	.739 ***	.618 ***	.431 ***	.559 ***	.560 ***
MRTLR	.258 ***	.775 ***	.303 ***	.515 ***	.348 ***	.422 ***	.292 ***	.428 ***
MRTVM	.390 ***	.894 ***	.437 ***	.684 ***	.419 ***	.330 ***	.421 ***	.416 ***
MRTS	.529 ***	.396 ***	.894 ***	.730 ***	.529 ***	.373 ***	.497 ***	.484 ***
MRTQ		.397 ***	.853 ***	.704 ***	.567 ***	.489 ***	.566 ***	.600 ***
MRTV			.452 ***	.727 ***	.477 ***	.452 ***	.440 ***	.517 ***
MRTL				.820 ***	.624 ***	.487 ***	.601 ***	.612 ***
MRTC					.744 ***	.589 ***	.679 ***	.726 ***

Table E Continued

	EPSD	EPSC	EPSR	EPSM
MRTR	.384 ***	.463 ***	.451 ***	.352 ***
MRTLR	.386 ***	.340 ***	.383 ***	.185 *
MRTVM	.225 **	.217 **	.223 **	.208 **
MRTS	.312 ***	.433 ***	.394 ***	.225 ***
MRTQ	.375 ***	.491 ***	.463 ***	.365 **
MRTV	.366 ***	.336 ***	.363 ***	.238 **
MRTL	.391 ***	.527 ***	.488 ***	.338 ***
MRTC	.507 ***	.604 ***	.590 ***	.406 ***

	SATR	SATM	SATT	EPSD	EPSC	EPSR	EPSM
SATA	.566 ***	.673 ***	.761 ***	.593 ***	.680 ***	.678 ***	.375 ***
SATR		.626 ***	.948 ***	.819 ***	.795 ***	.839 ***	.366 ***
SATM			.812 ***	.603 ***	.654 ***	.657 ***	.546 ***
SATT				.821 ***	.836 ***	.865 ***	.454 ***

Table E Continued

	EPSC	EPSR	EPSM
EPSD	.809 ***	.942 ***	.393 ***
EPSC		.955 ***	.529 ***
EPSR			.493 ***

* $p < .05$.

** $p < .01$.

*** $p < .001$.